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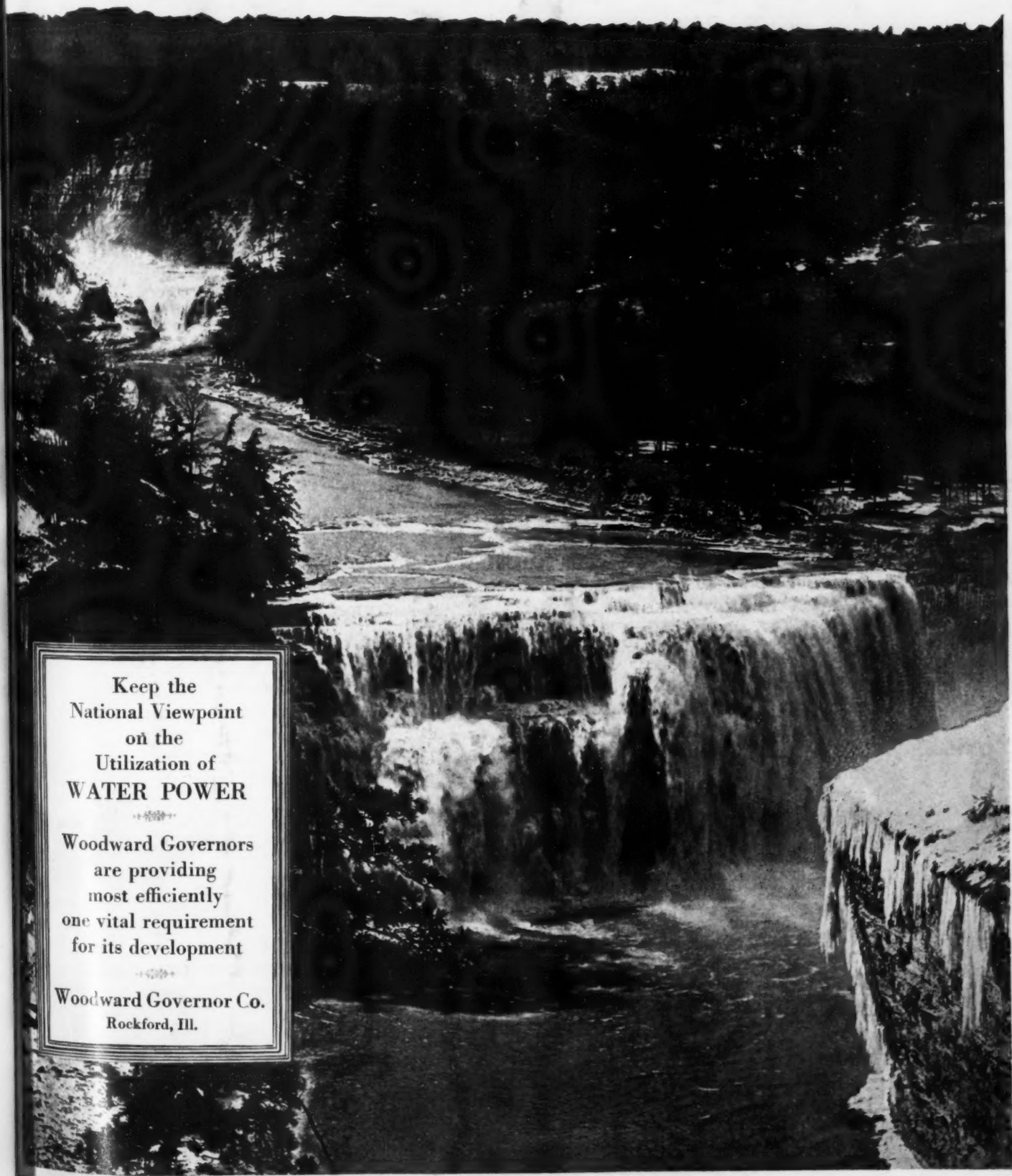

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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Another Bubble to Pin-Prick

THERE will doubtless be no more than academic interest in the latest superpower bill, introduced into Congress on Monday of this week by Senator Norris and Representative Keller. The bill proposes that the basis of a national superpower network be the municipal plants of the country (whose total output is 3 per cent of the country's generated power annually and whose average rating is under 400 kva.), and engineers may possibly derive some entertainment by calculating the ability of these plants even to provide the necessary charging current for the network. The bill is proposed as a conservation measure by the Public Ownership League of America, whose recent convention in Washington attracted a total of seven people, including the secretary! However sincere these people and the congressional backers of the bill may be as conservationists, they will be recognized as mere tyros when compared with Roosevelt, Pinchot and others who backed the present water-power bill, the result of years of study and under which water-power development is now proceeding rapidly in the public interest and at minimum cost.

Electrical engineers and all who have any appreciation of the technical and financial aspects, not to say social and political phases, of the general problem will fully appreciate that the American public is not going to drop plans under which it sees electrical development in the United States outstripping that of any other country on earth for a visionary plan representing the queerly combined effort of dreamers and politicians.

Engineering Education and Industry Interest

WITH his usual clarity and forcefulness, Dr. Henry S. Pritchett, in his report as president of the Carnegie Foundation for the year ended June 30, 1923 (just issued), makes two statements which go to the root of technical training principles.

He says: "The public school makes its greatest contribution to training in the crafts when it teaches boys and girls in the elementary school to do such work as will give them the discipline of mind and the accuracy of knowledge necessary to those high and honorable vocations which find expression in a sincere and accurate craftsmanship." This is definite encouragement to the sound trade training so necessary, so often emphasized, in the engineering industries.

His statement that "The close individual relation between pupil and teacher has broken down under the weight of the machinery of education" must appeal to all who are close students of the problem, and, in connection with college education, it points to the necessity, so often urged, of seeing that there is an ample supply of engineering teachers whose personality and ability rise above educational machinery. Engineering educators should be congratulated on what they have accomplished under the handicaps which beset them. While their numbers contain many of the thoroughly competent type, a larger number of cultured, inspiring and liberal-minded teachers are necessary who can be kept in personal contact with students and arouse in them a spirit of emulation and enthusiasm which no period of time can dull. It is in the industry's interest as well as in public interest that this work is being done, and industry should see to it that the money necessary is forthcoming to provide enough of the right kind of men to educate the future engineers.

Polarity of Distribution Transformers

DISCUSSION pro and con on the oft-proposed standardization of all transformers to a subtractive polarity is again active in the various engineering and commercial organizations interested. The present accepted practice of additive polarity for all distribution transformers up to 200 kw. is again being attacked, and, although it seems at times that it will be adhered to permanently, the advocates of the change are once more heard from insistently and discussion is started anew. The matter should be settled once and for all as soon as possible. Fruitless discussion would then be eliminated, and the change, if found advisable, would be made more readily, more cheaply and with less trouble than it could at a later date.

The chief advantage of a uniform polarity for transformers is, of course, standardization. Standardization, however, in itself is of no material consequence unless it brings results that in the main will benefit the industry. Standardization for standardization's sake alone is of very questionable advisability. Standardization of transformer polarity should therefore be judged from the material gain that it would give. The questions that should be answered as a test should include:

(1) Will manufacturing cost of transformers be reduced?

(2) Will more reliable apparatus be constructed?

(3) Will the necessary stocks carried by makers and users be reduced?

(4) Will some confusion be avoided in operation?

The answer to each of the first three questions is, of course, "No." And the answer to the fourth is that confusion will be eliminated whenever it is necessary to handle or connect together transformers whose sizes are above and below 200 kva. or when transformers of 200 kva. or less are replaced by some that are larger than 200 kva. and vice versa. The number of such cases is naturally quite limited. But standardization

will make it possible for men in small properties who have to handle all sorts of transformers—distribution, station, power, etc.—to know that any transformer they approach has its connection according to a standard plan.

Doubtless, changing the polarity of distribution transformers will cause confusion for many years in the operation of distribution systems owing to there being transformers of two polarities on the lines. Some operators feel that this condition would so seriously affect satisfactory operation that they are not inclined to try the change. Others are willing to make it for the sake of standardization and believe that their men can be trained to avoid mistakes. But, according to current reports, there is danger that some companies will refuse to accept the standard of subtractive polarity for distribution transformers. This would make it necessary for the manufacturers to build transformers of both polarities, which means the antithesis of standardization. Such a condition would be very serious as it would materially increase the cost of transformers to all users, particularly on account of the necessity of carrying double stocks in many of the makers' warehouses. It is evident that any change in the present polarity of distribution transformers would be a serious economic loss unless all users would immediately accept the new standards.

Whatever may be finally decided in this matter of polarity of distribution transformers should be decided immediately, and all should co-operate in finding means of obtaining a decision that represents the desire of the majority. When all are satisfied that an honest effort has been made to solve the problem for the good of the industry, there should be no difficulty in eliminating further wasteful discussion and adopting universally what has seemed the best standard.

Keeping the Customer's Equipment Up to Date

THE central-station company's responsibility for keeping its customers informed of new and better methods in the utilization of electric service is strikingly illustrated in the recent commercial lighting experiences of the San Francisco and Cleveland companies. With systematic selling effort and at a very moderate cost, both companies have materially increased their revenue from a large number of commercial lighting customers. But, aside from the additional business gained, the one thing that stands out in both cities is the fact that many storekeepers were already convinced of the value of better lighting. They were merely waiting for some one to offer the proper recipe.

How long these merchants would have continued to put up with inadequate and often antiquated illumination it is impossible to tell. That would have depended in each case upon the strength of individual inertia. The fact remains, however, that they did not know how to go about improving their store lighting until the central-station representative came along and showed them the way. All of which goes to show that electric light and power companies can ill afford to delegate to any other agencies the whole responsibility of selling electric service and the means of using it. Even if it were not for the incentive of increased revenue, the central-station company is morally bound to help its customers keep abreast of the times in things electrical.

Be Prepared to Change Again if Necessary

MANY plans and proposals for modifying secondary distribution systems to meet increasing demands for service are now under discussion. Three-phase, four-wire, 110/199-volt or 120/208-volt; two-phase, five-wire, 115/230-volt, and a continuation of present systems, with 230/460 volts on the lines and 115/230 volts on customers' premises, are among those proposed. Extensive calculations are made to show comparative economy in both fixed and operating costs. The effect upon lamps and appliances and transformers is taken into account.

But there is one element so far lacking in most of these calculations and that is the obsolescence factor. It is difficult to see what the demands on secondary systems will be during the next seven to ten years. Due weight must therefore be given to the question of how readily the proposed plans will lend themselves to further modification a decade hence. No plan must lead to a dead-end side track.

Improvements in Static Condensers

THE important and valuable property possessed by electrostatic capacity of taking a leading current under alternating voltage has long seemed to demand utilization as a simple method of power-factor correction for commercial circuits. The condenser is a stationary type of equipment and should take its place beside the transformer in the matters of reliability and life. Designing engineers have, therefore, often looked longingly toward the electrostatic condenser in all conditions in which low power factor is an inherent feature. It will be remembered, for example, that one of the earliest types of alternating-current motor, the Stanley, was provided with static condensers for the improvement of its power factor.

Unfortunately, however, it has never been possible to construct a static condenser which combines in a sufficient degree the factors of capacity, reliability and low cost, and it is for this reason that over a long period of years the static condenser has been, for the most part, neglected for use on power circuits. In recent years, however, the immense value of the synchronous condenser for power-factor correction for large blocks of power has emphasized the desirability of some cheaper method for utilization where smaller blocks of power are involved, as, for example, in the case of the individual consumer. In addition to this the increase in volume of radio transmission and such special applications as the rectification of alternating currents by means of thermionic tubes have combined to stimulate a renewed interest in the possibilities of the static condenser. Condensers differ principally as regards the dielectric used. The better known dielectrics are air, glass, mica, oil and impregnated paper. The important electrical characteristics are high dielectric strength and low dielectric loss. From the standpoint of dielectric strength mica, glass and oil are conspicuous, while from the standpoint of low loss air and mica stand out. Mica and air are practically eliminated, except for condensers of very low values of electrostatic capacity. Glass is unsuitable for obvious reasons, and the use of oil alone involves large size and mechanical difficulties. As a result the most

practicable condensers have impregnated paper as dielectric. Early condensers of this type used paraffine as impregnating material. This type of condenser has been used for years, but suffers the serious disadvantages of low dielectric strength and high dielectric loss. Recent careful investigation of the causes of these troubles has shown the possibility of very great improvements, some of which are indicated in the paper by R. E. Marbury presented at the Philadelphia convention of the A. I. E. E. As a result of careful control of the properties of the paper, the use of high-grade oil as impregnating compound and the use of careful drying and impregnating processes in assembly, there has resulted a commercial product which presents very noticeable improvements over former condensers of this type. For example, a 2-kva., 2,300-volt, 60-cycle unit with a dielectric loss of only one-half of 1 per cent of its rating has a size only slightly greater than half a cubic foot.

In discussing condensers it is important to remember the great promise which has sometimes been seen in the properties of the electrolytic film. Condensers based on this principle have been proposed, and it is known that serious effort has been made to develop a commercial product. The great promise in this type of condenser is the large capacity per unit volume and its low loss. It is not at all improbable that we shall hear of the successful overcoming of the difficulties which have so far prevented the realization of a practicable condenser of this type.

Transmission in Metropolitan Areas

WHILE many engineers are working on long high-voltage transmission lines in order to determine stability limits, methods of control and other elements connected with satisfactory and economic operation, another group is working on an equally difficult transmission problem brought about by the changed conditions in metropolitan areas. In several cities large steam stations are to be interconnected by high-voltage lines with tap substations at important distribution centers. Moreover, many of these systems will have high-voltage tap lines from distant water-power stations or from neighboring transmission systems. These systems must be engineered on the basis of having fixed voltages at several different points and also of being able to interchange very large amounts of energy in either direction over one or more interconnected high-voltage, but short, transmission lines. The load dispatcher normally must be able to supply the necessary energy at the point where it is demanded and at the proper voltage, and in addition he must be able to use the most efficient stations for supplying the load on the system. In the emergency of a short circuit an immense kva. must be handled, troubled sections isolated and loads transferred at will. And under all conditions service reliability and quality are paramount. Needless to say, there are some major engineering problems associated with systems of this kind. The control must be accurate, quick and reliable. Fortunately radio, either wired or wireless, has come to the front to place a most promising tool in the hands of engineers studying control.

The energy interchange between stations can be determined by governor adjustments, but there are wattless components which must also be produced, transmitted and controlled, and these are fixed by voltage and power-factor conditions. On multiple interconnectors the load division between lines is fixed by their impedances and not by terminal voltage conditions. Thus it may be necessary to raise or lower the voltages included in a system and to adjust the governors at the different terminal stations or substations, or to vary voltage or power-factor conditions along the line if the terminal voltages are fixed by other considerations.

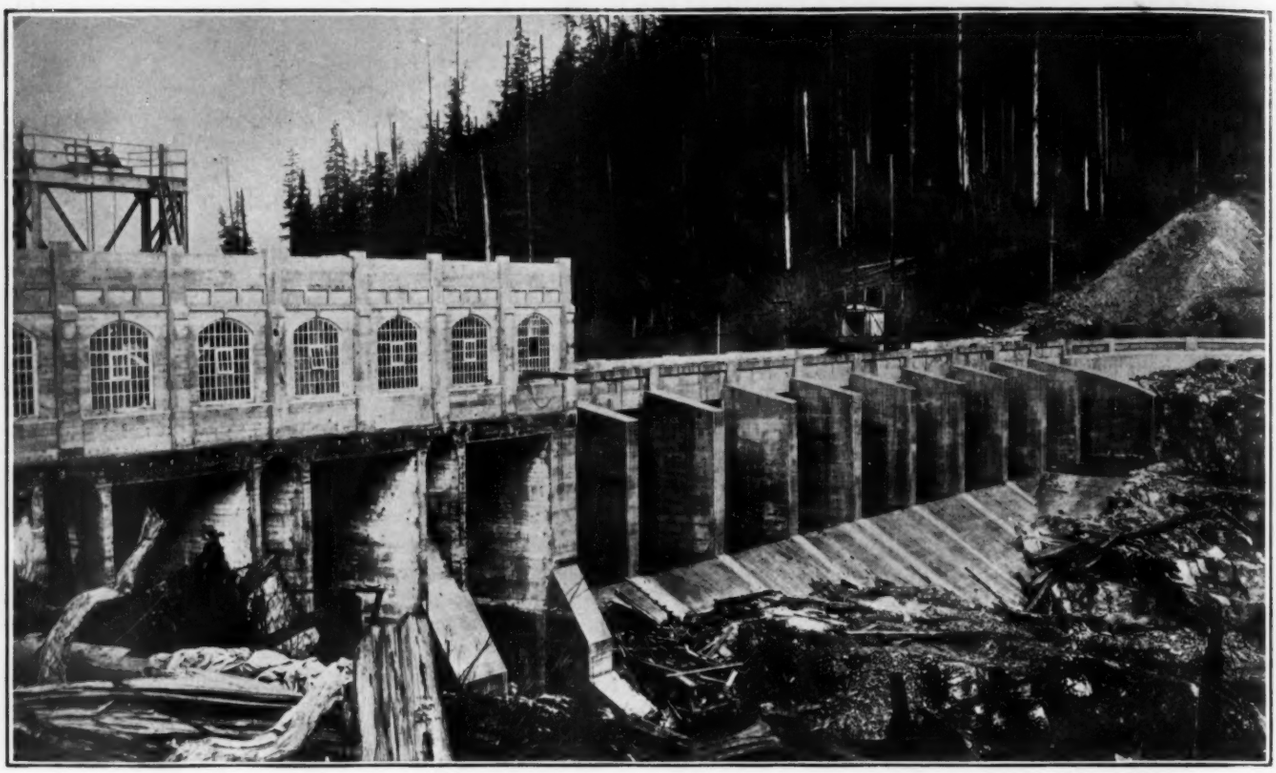
Apparatus available for doing this work may be classed as synchronous condensers, synchronous boosters with stator phase adjustments, induction regulators, variable tap transformers and special transformers. For high-voltage, large-power interconnections and for a wide range of voltage adjustments, combinations of single and three-phase induction regulators are slow, costly and unsuitable unless supplemented by other devices. Synchronous condensers and boosters, on account of their cost and their low voltage and the fact that the system operates at less than unity power factor, have a limited application. Thus voltage changes obtained by using some type of transformer are left as the most general and least expensive method.

These transformers must be installed at the proper places to take care of voltage adjustments, so as to allow energy to be transmitted in either direction independently of connecting-line impedances, and must have windings adjusted to the requirements of the phase angles necessary for the required divisions of load. Tap changing and special or multiple windings are used on such types as have been so far developed, but all of these give rather large steps and experience difficulty in making all required adjustments when the system is operating under loaded conditions.

Thus the metropolitan transmission engineer must still face great difficulties which the synchronous condenser has solved for the long-line engineer and must adapt existing equipment in a variety of ways for each major energy point on his interconnected system. There will be some very great developments made in the near future when data are available from metropolitan companies now installing this type of high-voltage, interconnected system.

Testing Cable Insulation When It Is Cold

THE precept "Test the insulation when it is hot" has been quite thoroughly drilled into the present generation of electrical engineers. So when cable experts, referring to the power loss in cable insulation, now say to "test it cold" the first thought is to try to find out who finances the new slogan. But then it is explained that the dielectric loss proper has been reduced to a harmless amount, and that the new enemy, ionization in minute air spaces, is particularly large at low temperatures and disappears at high temperatures. As the progress of the art demands cables of higher and higher voltage, with relatively thinner and thinner insulation—that is, higher and higher dielectric stresses—this ionization is apt to become the limiting factor. The same experts also tell us that, because of this ionization, the time may come when it will be necessary to preheat a cable by a low-voltage current before it is safe to subject it to the rated voltage. Truly, a cable engineer must be prepared to reverse his views and methods on short notice, and his only safe guide is a constant, careful study of the physical laws governing the operation of high-tension cables.



Water Storage Used in British Columbia

THE Blind Slough Dam, shown in the illustrations, was constructed by the British Columbia Electric Railway Company at Stave Falls, B. C. It is completed with the exception of ornamental lamp standards and other details. The dam was constructed in connection with the company's Stave Falls development. It raises the level of Stave Lake 22 ft. and increases the water storage from 168,000 acre-feet to 465,000 acre-feet.

The dam is 640 ft. in length, consisting of ten bays of stop logs and four bays in which Tainter gates are installed. Construction was started in April, 1922, and the dam itself completed in November, 1923. In all 20,000 cu.yd. of concrete was placed, in addition to which 22,000 yd. of concrete was placed in other work at the main power-house dam and at the intake dam. This work was part of the general scheme increasing the capacity of Stave Falls power plant from 35,300 kva. to 55,125 kva. The additional equipment is to be installed this year.

Transmission at 220,000 Volts

Factors Which Led the Southern California Edison Company to Operate at This Tension — Line Insulation — Handling Charging Current and Flashovers — New Bus Design — The Switching Problem

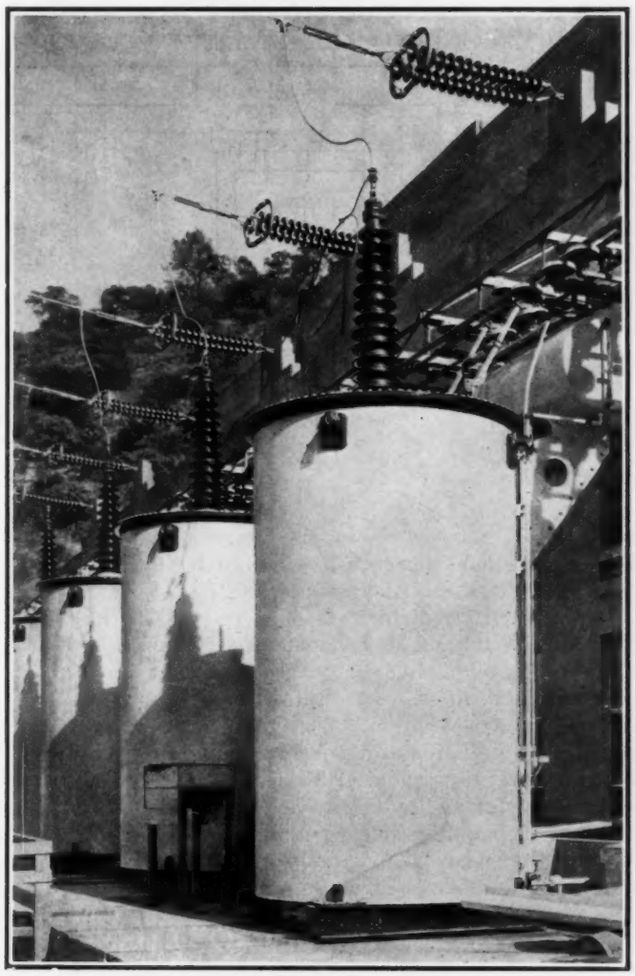
By H. A. BARRE
Executive Engineer Southern California Edison Company

AFTER two years of careful research by the engineers of the Southern California Edison Company and about a year spent in the reconstruction of its two Big Creek transmission lines for operation at 220 kv., the first of the two lines was actually placed in operation at this world's record voltage on May 6, 1923, at 6:12 a.m. The conversion of the Big Creek lines from 150 kv. to 220 kv. was brought about by the necessity for additional transmission capacity between the Big Creek hydro-electric development and the city of Los Angeles.

Operating at 150 kv. over a distance of 240 miles, the Big Creek lines, as constructed in 1913, had a capacity of 150,000 hp. In addition to transmitting the energy from the chain of plants in the Big Creek development, these lines during a part of the year also carry the production of the Kern River No. 3 plant from Vestal substation in the San Joaquin Valley to the Eagle Rock receiving substation in Los Angeles. With an output of 135,000 hp. at the Big Creek plants and 42,000 hp. at Kern River No. 3, these lines were loaded to capacity. The company's 1923 development program called for an additional unit of 22,000 hp. at Big Creek No. 1 power plant and the construction of a new plant, to be known as Big Creek No. 3, with an initial installation of 100,000 hp. It was therefore necessary to provide additional transmission facilities for this additional production, either by constructing a duplicate set of 150-kv. transmission lines or by reconstructing the existing lines for operation at 220 kv. After a comparison of the cost of the two plants it appeared that the lines could be reconstructed for 220 kv. at a saving of approximately $7,000,000 over the cost of building a duplicate set of new 150-kv. lines.

While the electrical manufacturers were willing to construct transformers to operate at 220 kv., a transmission line for that voltage had never been built before, and it remained for the engineers of the Southern Edison company to design a line and means of insulating it for this voltage. Working in conjunction with Prof. Harris J. Ryan of Stanford University, and with the equipment and insulator manufacturers, the company conducted elaborate tests on various combinations of insulators with and without different types of shielding devices.

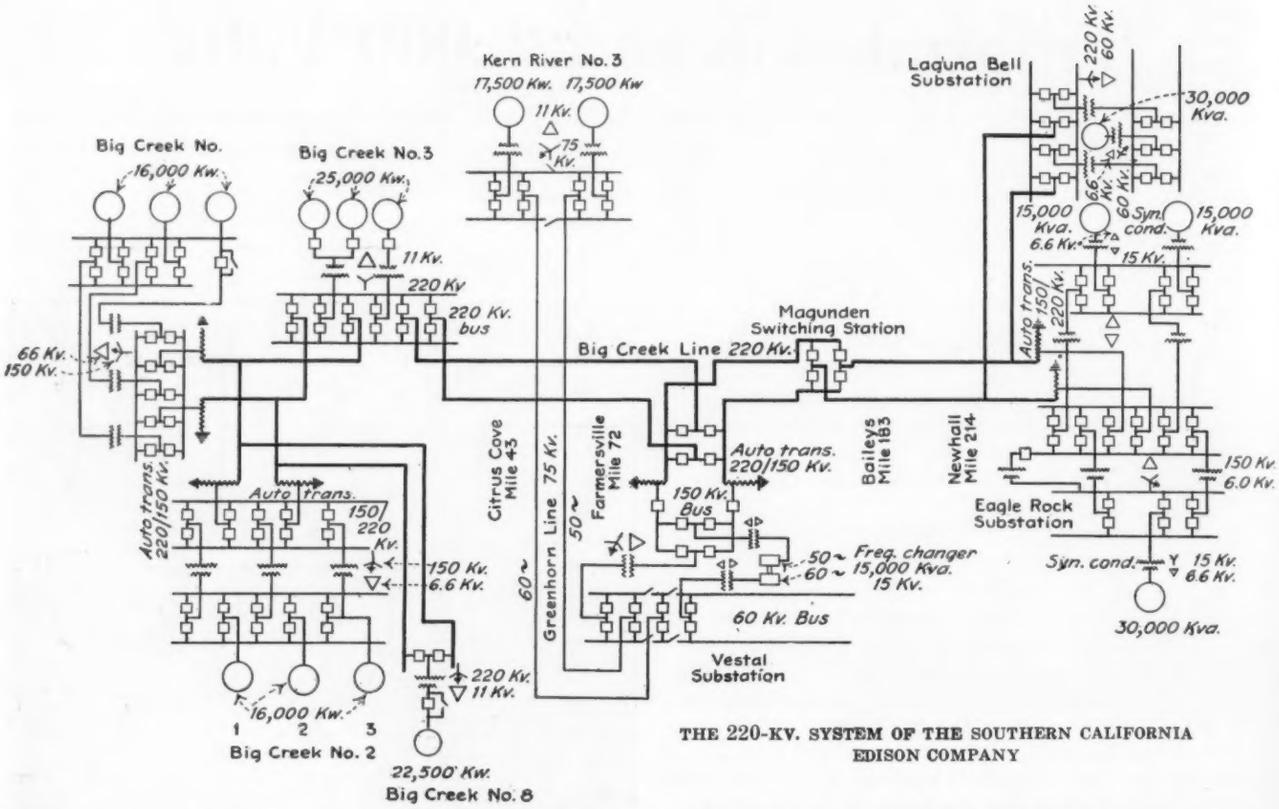
It was found that by placing a metal shield ring around the insulator next to the conductor and by adding two insulators to the existing strings sufficient insulation could be obtained for 220 kv. Supplementing these laboratory tests, a 27-mile section of one of the Big Creek lines was taken out of service and equipped with these shield rings. It was energized from Eagle Rock substation at 280 kv. and later lowered to 240 kv., at which voltage it was kept for about five months. These tests showed that no difficulty might be expected in operating at 220 kv. Accordingly a decision was reached to adopt the plan of converting the Big Creek lines for 220-kv. operation.



BANK OF 220-KV. TRANSFORMERS AT BIG CREEK NO. 3 POWER HOUSE. NOTE THE TYPE OF 11,000-VOLT BUS CONSTRUCTION USED

In making this voltage change many difficulties were encountered. The addition of insulators to the strings so decreased the clearances to ground that in many cases it was necessary to raise the towers. This was done while the line was energized (see ELECTRICAL WORLD for October 6, 1923, page 695) by lifting the towers bodily and adding another section. When it came to redesigning the indoor bus structures at the Big Creek power houses and at Eagle Rock substation for 220 kv. it was found that it would be necessary to reconstruct the buildings to get adequate clearances. This problem was finally solved by installing banks of 150-kv. to 220-kv. auto-transformers at each 150,000-volt power house and substation and not taking the 220 kv. indoors.

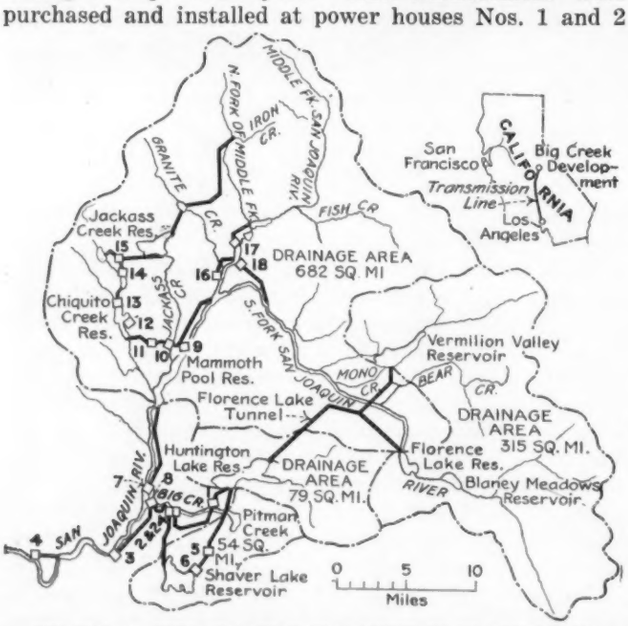
The auto-transformers are connected solidly in the



THE 220-KV. SYSTEM OF THE SOUTHERN CALIFORNIA EDISON COMPANY

lines and are operated as an integral part of them. There is one bank for each line, and each bank is capable of carrying the total load of the station to which it is connected. All switching is done on the 150-kv. side, except at Vestal and Magunden substations, where there are 220-kv. oil switches for sectionalizing and cross-connecting the lines. Each auto-transformer is supplied with a tertiary winding. These are connected in delta to supply a path for any third harmonic present in the voltage wave, thus avoiding high insulation stresses.

The work of adding additional insulator units to the line and of installing shield rings had been carried along during the previous year. Auto-transformers were purchased and installed at power houses Nos. 1 and 2 and at Vestal and Eagle Rock substations. Auto-transformers were not required for power house No. 8, since the step-up transformers at this point were designed for operation at 220 kv. With the completion of all this work the west Big Creek line was made ready for cut-over on Saturday night and Sunday morning, May 5 and 6, 1923.



BIG CREEK HYDRO-ELECTRIC DEVELOPMENT OF SOUTHERN CALIFORNIA EDISON COMPANY

METHOD OF CUT-OVER

The program was planned to carry out the various steps necessary in the cut-over in the most careful manner. The first step was to change the taps on the step-up transformers at power house No. 8 from 150 kv. to 220 kv. This work was started at 8 p.m. after the peak load of Saturday night. The auto-transformers at the various power houses and substations were also connected to the west Big Creek line. By 5 a.m. Sunday everything was ready to energize the line. Power house No. 8 was connected to the line and the generator slowly brought up until it was generating at 35 cycles. The voltage on the line was then raised to approximately 160 kv., this bearing about the same proportion to 220 kv. that 35 cycles bears to the normal frequency of 50 cycles.

The second step was to transfer the 30,000-kva. condenser at Eagle Rock substation, which had previously been running on the 150-kv. line at 50 cycles, to the west Big Creek line. This was accomplished by disconnecting the condenser and permitting it to coast down to the speed of approximately 35 cycles, at which speed it was connected to the Big Creek line.

The third step was to increase the speed and excitation of the generator at Big Creek No. 8 until it was operating at 50 cycles and the line voltage was raised to 220 kv.

The fourth step was to synchronize at Eagle Rock the west Big Creek line with the east Big Creek line and with the general Edison system.

The fifth step was to parallel at Big Creek No. 1 the east and west lines operating at 150 kv. and 220 kv. respectively. This system of operation was continued during the following week.

On Saturday night and Sunday morning, May 12 and 13, the auto-transformers were connected into the east Big Creek line and that line was switched into service at the full voltage of 220 kv., a section at a time, the longest section being 100 miles.

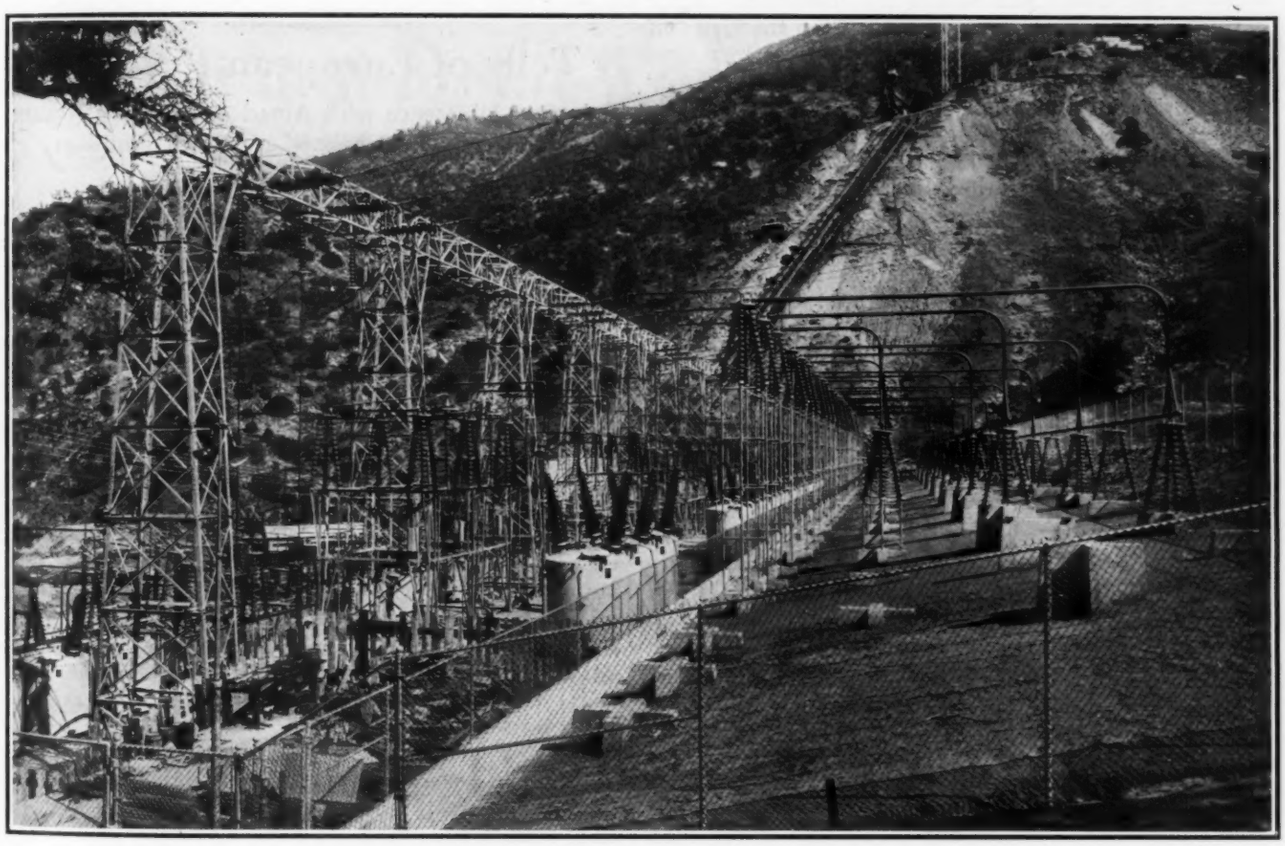
While the subject of insulation is highly important, the question of the relation of the field excitation of the generators to the operation of the line is hardly less so. It is, of course, well known that the charging current in a long, lightly loaded transmission line acts to overexcite the generator fields. In the case of the operation of the Big Creek lines at 150 kv. it was found that one of the generators at power house No. 1, operating over a single circuit of 240 miles of line at normal speed and without any direct-current field, would build up its voltage to slightly more than 100 per cent of normal and show an output of 126 per cent of full-load kva. One of the machines of a different manufacturer, but of the same capacity, would build up its voltage without any direct-current field to nearly 150 per cent of full-load voltage and nearly 200 per cent of full-load kva.

In order to maintain a stable voltage under such conditions as this it is necessary to handle the line with two or more generators in parallel in order to divide this charging current between the machines operating and thus obtain sufficient positive field to stabilize the machine and line voltage. If this factor is neglected, it is quite possible to produce voltages much in excess of normal and entirely beyond the control of the voltage regulators and limited only by the saturation characteristics of the generator iron.

Accordingly, in operating a system of this kind, care must be taken in the design of the machines to make them as stable as possible when operating under light loads and to carry a sufficient number of machines on the line at all times to retain positive control of the voltage. In operating at 220 kv. these conditions are, of course, more important because of the increased charging currents to be handled, and must receive more care in both design and operation. This condition may result in the utilization of generators of capacities of not less than 50,000 kw. in future installations in the Big Creek plants.

In the operation of the Big Creek lines at 150 kv. certain flashovers were experienced from time to time. These flashovers did not appear to be the result of defective insulators. For a considerable time every string of insulators which flashed was removed from the line and tested in the laboratory, and it was only occasionally that defective insulators were found. The cause of these flashovers has never been satisfactorily explained. It was anticipated that the flashovers would continue when the operating voltage of the line was changed to 220 kv., and relays were provided for the purpose of minimizing their effect on the system.

The devices for so doing are of two kinds—first, a relay operated by current in the ground leads of the transformers, which by acting on the generator field circuits momentarily drops the voltage to the point where the arc is extinguished and restores normal conditions as soon as the ground current ceases to flow. This procedure was until recently carried out manually by the station operator with successful results. Late in 1923 the automatic flashover suppressor system was completed. Its operation has been most satisfactory and has entirely fulfilled expectations.



220-KV. BUS AND SWITCHING STATION AT BIG CREEK NO. 3

The second means which has been provided is the application to the system of relays operated by unbalanced currents in the sections of line between cross-over stations, by this means disconnecting the section of line in trouble from the system, thereby extinguishing the arc and allowing the section so isolated to be replaced in service immediately. Both of the 240-mile lines are now protected in this manner, and the 220-kv. oil circuit breakers have been functioning satisfactorily under all operating conditions.

Every effort has been made to determine the cause of the flashovers during nearly a year that the lines have been in operation at 220 kv. It is quite probable that no single cause is responsible for all of them. There is evidence that part of them are caused by birds building nests in the towers and soiling the insulators. Steps have been taken to provide guards to keep the birds off the towers, but so far no thoroughly satisfactory type of guard has been developed. The nests are largely those of hawks, buzzards and other large fowls and the nest material is frequently found hanging down over the insulators. After oscillograph tests and the closest of observations to ascertain the cause of flashovers, it is generally conceded that in some cases at least the birds are the culprits.

Bus Construction

The type of 220-kv. bus construction used at the Laguna Bell receiving substation in Los Angeles and the new Big Creek No. 3 plant is of interest (see accompanying photograph). The usual overhead supporting steel structures are not used. The busbars, which are of 4-in. standard iron pipe, are supported on pillar insulators, each of which has in its base a small concrete pier set directly on the ground. The branch busbars, also made of iron pipe, are welded to the main bus and braced at the point of attachment by knee braces of iron pipe welded in on each side of the branch. In this way a stable structure of moderate height is obtained. A description of this type of bus structure appeared on page 919 of the ELECTRICAL WORLD for Nov. 3, 1923.

Voltage Not Limiting Factor

It does not appear that voltage is the determining factor in the design of a transmission line of this kind. It must be remembered that the line is only one element of the co-ordinated system and that a line of this high voltage must carry enormous amounts of power to become commercially successful. The switching equipment for this great amount of power at high voltage seems to be the link in the chain which must be strengthened before any further advance becomes practicable. Although force of circumstances made it necessary for the Southern California Edison Company to be the first in the field in the actual commercial operation of transmission at 220 kv., it must be remembered that the success of the development is not due to any one man or company. It is the result of the fullest possible cooperation between the apparatus manufacturers, the testing laboratories at Stanford and the California Institute of Technology, as well as the work of the engineers of the Pacific Gas & Electric Company, the Great Western Power Company and the Southern California Edison Company. The work done by Prof. Harris J. Ryan, Frank G. Baum, F. W. Peek, Jr., Charles LeG. Fortescue and O. A. Austin, as well as that of J. P. Jollyman, J. A. Koontz, H. Michener, R. J. C. Wood and A. E. Silver, has been of the utmost importance in the successful carrying out of the project.

It is sincerely to be hoped that other lines constructed for 220-kv. operation will be worked out according to some of the other plans of insulation and operation that have been suggested, in order that comparisons may be obtained and improvements developed as quickly as possible. With the two Big Creek lines of the Southern California Edison Company and the Pit River line of the Pacific Gas & Electric Company now in operation at 220 kv., much valuable operating experience at this higher voltage should soon be available.

That 220-kv. transmission is an economic necessity and that it is thoroughly practicable is evidenced by the fact that the Southern California Edison Company will start construction on two more circuits at this tension from its Big Creek development to Los Angeles during 1924.

Tells of European Practices

Points of Difference with America and Some Notable Methods Are Described by B. G. Jamieson Before Chicago Engineers

IMPRESSIONS which B. G. Jamieson, engineer of inside plant, Commonwealth Edison Company, received while on his tour through ten countries in Europe, in company with four other Commonwealth Edison men, were related in Chicago recently before the Western Society of Engineers and the Chicago Section, A. I. E. E., with the aid of lantern slides. Among the things pictured were the large cooling towers used by some central stations, the large armored switchgear developed in Great Britain and said to have a capacity of about 2,000,000 kva. at 33,000 volts, the stored-steam locomotives used around plants, employment of outdoor spacing for indoor electrical installations, oil-immersed copper-clad reactors, Venturi stacks, high-speed air-type circuit breakers with resistance in the intermediate stage of rupture having a speed from rest to rest of 0.004 second, the national electrification of France without regard to immediate economies, and the adoption of 1,500 volts direct current for railroad electrification.

Mention was made of the use of 400-volt to 1,500-volt iron-clad mercury-arc rectifiers and the willingness of the manufacturers to build them for 3,000 volts and even 6,000 volts. These rectifiers operate in parallel with converters and are provided with mercury seals and special anodes which will not emit gas. Among the features are ability to take on a full load within forty seconds if the vacuum has not been impaired, their very straight efficiency curves and the very small fluctuation, not in excess of 6 per cent, in rectified voltage and current. Attention was also called to some European rotary converters which are guaranteed to withstand five dead short circuits across their brushes at sixty-second intervals and which have withstood as many as 150 such short circuits.

Mr. Jamieson referred to the extent of national electrification in Europe by government decree, the high voltage of transmission systems for the power delivered and the distance covered, the extensive use of 220-volt lamps, the poor voltage and frequency regulation and the uniformity of equipment. The high power output per pound of material in equipment was touched on, it being brought out that this is due to the use of 50-cycle, 3,000-r.p.m. rotary apparatus which is said to develop 60 to 70 per cent more work per pound of material than 60-cycle, 1,800-r.p.m. equipment. The extensive

use of single-phase generators and mercury-arc rectifiers, the segregation of direct-current networks, the small use of reactors, the universal employment of shaft-driven exciters except in water-power plants, the quality of high-tension underground cable and the development of static condensers and induction motors with reduced starting current were subjects discussed.

England was commended by the speaker for the excellent oil-circuit-breaker research which is going on there, as was the Swiss firm of Brown, Boveri et Cie. Europeans make their circuit breakers with appurtenances like resistors, multi-breaks, etc., to reduce the cost, Mr. Jamieson explained, whereas in England they try to protect against the stresses developed. Particular attention was called to some very exhaustive tests which are being conducted at Newcastle to determine the phenomena of breaking an arc under oil and the conditions which affect it. These tests are under the auspices of the government and the British Institution of Electrical Engineers.

Water-power stations are spacious, Mr. Jamieson continued, not crowded like some American stations. In Sweden substations rated as high as 40,000 kw. are in operation, and automatic operation is being adopted quite extensively. One-hundred-thousand-volt direct current has been employed in France for several years, and plans are now under way to change to 30,000-volt direct-current underground transmission.

Wood and Metal-Working Machinery Motor Requirements

Applications of the Former Kind Require High-Speed Drive —Variable and Adjustable Speed Requirements Must Be Met on Lathe Applications—Trend in Development

By H. C. JORSTAD
General Engineer Westinghouse Electric & Manufacturing Company

METAL-WORKING and WOOD-WORKING machines are similar in that both are used for shaping materials used in the fabrication of finished products. Here the similarity ceases to a large extent as the wood-working machine is essentially one which operates at high speeds, while, with the exception of various types of grinding machines, the metal-working machine tool is a comparatively low-speed machine.

Wood-working machines, particularly molders, double and single-end tenoning machines, surfacers, planers and jointers, circular rip and swing-cut-off saws, small hollow-chisel mortisers and single-spindle borers are readily adaptable to the use of a small two-pole, 3,600-r.p.m., 60-cycle squirrel-cage motor directly applied to each cutter head, spindle, or saw arbor. Coping saws, spindle shapers and routers are usually operated at higher speeds, so that a circuit of higher frequency than 60 cycles is necessary.

The motors used on these are, in general, of two types—the built-in type and the overhung type. The built-in type up to the present time has been used mainly in the smaller sizes ranging up to about 4 hp. at two-pole, 60-cycle speeds. A particular application of this type is the spindle shaper to which the 4-hp. motor mentioned is usually applied. The rotor is mounted directly on the spindle of the machine, and the wound stator is pressed into a housing made by the machine manufacturer. This housing can be of any exterior design desired by the manufacturer, but the inside construction must conform to certain requirements for satisfactory ventilation of the motor windings. Ducts must be provided between the outside of the stator punchings and the inner walls of the housing, and baffle plates must be provided at either end of the stator, in order that air for ventilation may be drawn in at the bottom, over the end windings of the stator, through the ducts in the stator housing, finally passing over the end windings at the top and out. The necessary fans are ordinarily supplied by the motor manufacturer, but in certain cases an auxiliary fan is added by the machinery manufacturer.

While there are certain modifications in the application of these motors, in general the motor manufacturer supplies the wound stator, together with the rotor bored for proper fit and equipped with ventilating fans, and the machinery manufacturer builds these parts into his machine.

Although reference has been particularly to 60-cycle motors, the spindle shaper in a majority of cases is operated from 120-cycle frequency-converter circuits and runs at speeds of about 7,000 r.p.m.

The overhung type of motor finds its application to the heavier drives to a great extent, although they are built in sizes as small as 1 hp. A particularly typical instance of the application of this kind of motor is the four-side outside molding machine, which has two vertical and two horizontal heads. This is a machine which is used for making all sorts of moldings and other square-cut products. It is also sometimes called a sticker, since it is used for making sticks or matched pieces.

The rotors of the motors applied to these machines are pressed directly on the cutterhead or saw arbor and are overhung from one bearing. The stator, assembled in its housing, is then bolted to the side of the machine and overhangs from these mounting bolts. In the smaller sizes no outboard bearing is provided to aid in supporting the rotor, but for the larger ratings this is deemed necessary and a bracket or end bell carrying a ball bearing is mounted on the outer end of the motor frame.

Considering particularly the outside molder, this construction applies to both vertical and horizontal heads. The horizontal heads are stationary, while the vertical heads are adjustable through an arc of nearly

90 deg. in order to cut any angle on the side of the work as may be required.

In applying this type of motor the parts procured from the motor manufacturer are the stator, with its housing properly machined for fit, and the rotor, bored for proper fit on the machine arbor. The machinery manufacturer supplies the end bracket with outboard bearing and assembles the parts complete to the machine.

When the metal-working machine is considered there is found almost an opposite condition from that with the wood-working machine in that the majority of metal-working machines are so constructed that the material worked is revolved or reciprocated instead of the tool. The most prominent exception to this is the grinding machine, and it is interesting to note that

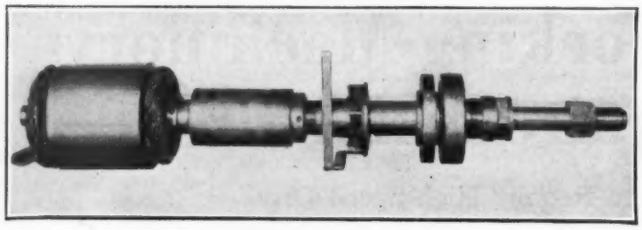


FIG. 1—EXPLODED VIEW OF THE DRIVING PARTS OF A SPINDLE SHAPER, SHOWING THE ROTOR MOUNTED ON THE SPINDLE

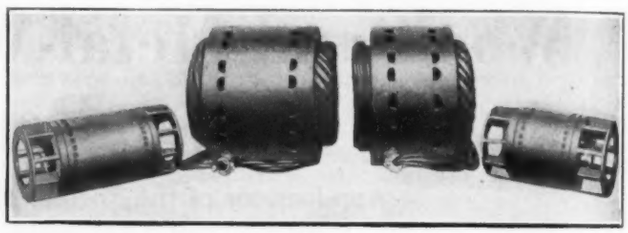
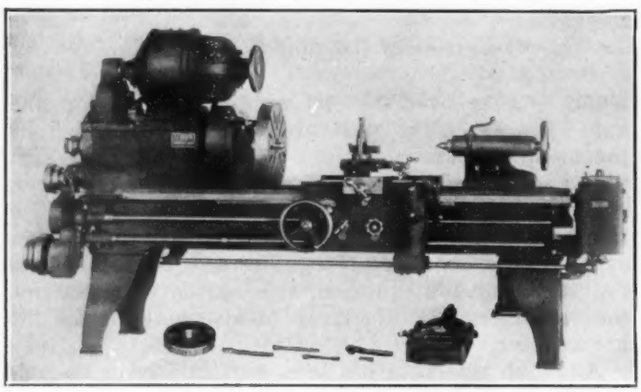
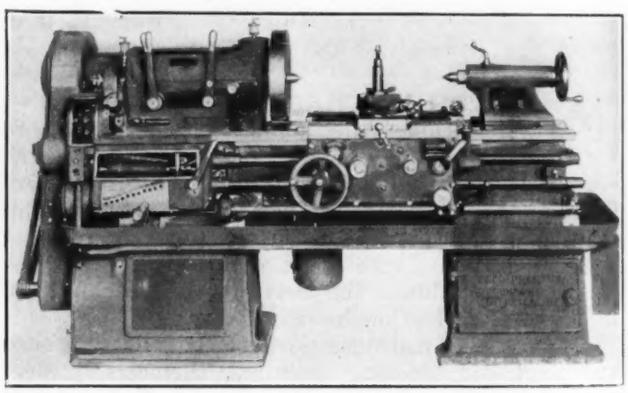


FIG. 2—ROTORS AND STATORS OF 10 HP. AND 15 HP., 3,500 R.P.M. OVERHUNG TYPE OF MOTORS





FIGS. 3 AND 4—A GEARED HEAD LATHE WITH MOTOR MOUNTED ON TOP OF HEAD AND A NEWER MODEL LATHE WITH THE MOTOR MOUNTED IN THE BASE

motor application to this type of machine closely parallels application to wood-working machines.

Nearly all of the more modern grinding machines have either a motor built into the machine or several motors coupled as directly as possible to the various drives.

When one considers the application of motor drive to such machines as engine and turret lathes, horizontal and vertical boring machines, universal milling machines, radial and multi-spindle drills, crank shapers and slotters and the like, it is discovered first that all of these machines require an operating speed range of somewhere around twenty or thirty to one. This immediately eliminates the possibility of using an adjustable-speed, direct-current motor to cover the entire range, as the highest practicable range of this type of motor is four to one. This means that it will be necessary to use a set of change gears to complete the range of speed required on the machine. Of course, the use of a three or four to one adjustable-speed motor is extremely desirable, since a rheostat with twenty or thirty points, which is common, coupled with the three or four gear changes, gives practically any operating speed possible to obtain over this range.

However, if a machine is built for use in a shop where alternating current only is available, in all probability the motor applied will be a constant-speed motor. This means that the entire speed range of the machine must be taken care of by the gear changes. It will be readily seen that the machine-tool manufacturer must necessarily have two designs for any one machine, a constant speed and an adjustable speed. This is quite a problem, as it plays a part in both overhead expense and production, and some manufacturers are seriously considering the abandonment of the adjustable-speed machine in favor of the more popular constant-speed.

Most tools of this type still use a motor which is built along the same lines as any general-purpose motor and is, in general, mounted on an extended bracket and either belted, chained or geared to the machine. There is a growing tendency in the trade, however, to make the motor more a part of the machine, or at least contrive to design the unit so that the motor does not appear to have been added as an afterthought.

It is difficult, however, for the manufacturer to go to a built-in construction on these types of machines on account of conditions in the market which demand that they be adaptable to both line-shaft and individual motor drive to suit various customers' requirements.

As a comparison of the two types of construction, Fig. 3 shows a geared head lathe with the motor mounted on top of the head, and Fig. 4 a newer model lathe with the motor mounted in the base. The great difference in appearance is obvious.

Starting and control equipments for motor drives on metal-working and wood-working machines cover a considerable variety of apparatus. Squirrel-cage induction motors of 5 hp. and less are usually started by across-the-line type starters. These impress full voltage across the motor terminals and are either of the hand or magnetically operated type. The hand-operated type may be either a simple knife or snap switch or a quick-break switch providing protection against overload or voltage failure. The push-button type also

usually incorporates the overload and low-voltage-protection features and consists merely of a magnetic line contactor and the necessary overload device.

For larger sizes of squirrel-cage motors the same general types of starters are used, with the exception that they provide for the use of an auto-transformer for supplying a reduced starting voltage to the motor.

In machine-tool application drum-type starters using the series resistance method are also used with constant-speed direct-current motors and for squirrel-cage induction motors. These can be either reversing or non-reversing as desired. Another combination is the use of a drum switch for reversing only in conjunction with a magnetic push-button-operated starter. These drum switches are quite often connected to a splined shaft of a machine tool so that they can be operated from the carriage of the machine.

Starters for adjustable-speed direct-current motors can be of either the reversing or the non-reversing drum type, embodying the field control points in the controller, or the magnetic push-button or drum master-switch-operated type. These magnetic starters may have various characteristics as desired.

The trade in general seems to be tending toward the use of the magnetic semi-automatic starting equipment since it is so much more convenient in operation and removes the responsibility for proper acceleration of the motor from the operator.

Thunderstorm Researches Versus No Lightning Arresters

By E. E. F. Creighton
General Electric Company, Schenectady, N. Y.

Comments by an American Authority on the Recent Article by Dr. H. Norinder Describing Researches on Thunderstorm Fields in Sweden and Giving Conclusions for Application to System Protective Devices

DR. H. NORINDER has made some valuable additions to our knowledge of atmospheric electricity (ELECTRICAL WORLD, February 2, 1924, page 223). To mention specifically some of these measurements of particular values, he has established that the pontential due to thunderclouds in the atmosphere around a transmission line is commonly of the order of 300,000 volts to 600,000 volts. Occasionally he has found more than a million volts. Putting these figures in more commonly used terms, the induced potential in the atmosphere at considerable distances from the thunderbolt is from 1 kv. to 4 kv. per centimeter. For comparison, the corona value is about 30 kv. per centimeter. Naturally a thunderbolt, in establishing a discharge through the insulating atmosphere, must have a potential about the corona value. Another important result recorded by Dr. Norinder is that the volume of the usual storm cloud affected by a lightning discharge is more nearly of the order of 1 km. in diameter than 10 km. Still another important observation of his is the record of the movement of clouds, some charged positively and others charged negatively.

Lightning Arresters an Economic Matter

When Dr. Norinder comes to his conclusions he voices the wishes of all of us who are interested in the safe and continuous transmission of electric power. Our hope is that some day we shall reach the condition where preventive measures will make lightning arresters unnecessary. This consummation, however, is still placed beyond the vision in the future. Volumes can be expressed sometimes in a brief analogy. For example, inflammable material may some day be so decreased in structures as to make fire insurance uneconomical. It is an expense to pay for insurance, but many do it. The use of lightning arresters is, like insurance, an economic matter.

Dr. Norinder's Conclusions

While it is with a sense of gratitude that Dr. Norinder's interesting data are reviewed, it is impossible to pass with agreement from his valuable researches to such of his brief conclusions as bear on protection of electrical apparatus. Three of his conclusions are: First, that "it seems unnecessary to assume the existence of high-frequency oscillations in lightning discharges"; second, that although a lightning discharge produces a high voltage wave (on the power line) its wave front is so slanting that "it may be that the power arcs following a secondary discharge [around a line insulator, for example] . . . have a good deal more to do with transformer punctures than the atmospheric surges themselves"; third, that "the inference is that the best system protection compromises strong line insulation and reliable interturn and intercoil insulation in the transformers, which make horn gaps and lightning-arrester equipment superfluous."

Dr. Norinder's data as published, no matter how valuable in their own field, are still insufficient, it seems to me, to justify any of these conclusions.

Historical Notes

Since the wave front and natural frequency of lightning are still debatable matters, it is of interest to review some brief historical notes.

Dr. Elihu Thomson in speculating on the effects of cloud lightning came to the conclusion that it was non-oscillatory (*Transactions A. I. E. E.*, Vol. 33, 1914, Part I, page 539). The late Dr. Steinmetz, by a different line of approach, came to the conclusion that it was oscillatory. L. A. De Blois in 1914 made some

valuable oscillograms of charges on short overhead wires induced by thunderclouds. Some of these induced charges were non-oscillatory. However, the changes in the potentials of the clouds were many times as rapid as those measured by Dr. Norinder. Furthermore, the sharp peaks and sudden changes of potential obtained by Mr. De Blois suggest that Dr. Norinder might well re-examine the degree of damping in his circuit. Is it possible that the earth resistance added to his line resistance has caused overdamping? The exact determination of earth resistance is somewhat difficult. Tests made by the writer in conjunction with J. A. Clay and F. W. Peek, Jr., in southwestern Colorado in 1906-07, showed rapid oscillations from line wire to ground. During these tests there was no power connected to the line. These illustrations could be easily multiplied. On the speculative side it seems that Dr. Thomson and Dr. Steinmetz were both right, depending upon which part of the thunder cloud is being considered (Creighton, *Transactions A.I.E.E.*, Vol. 33, 1914, Part I, page 536).

The Commonwealth Edison Company of Chicago made the most extensive practical tests ever attempted and concluded that the induced wave on the distribution lines from thunderclouds was of a steep wave front.

Lightning Choke Coils

We must agree with Dr. Norinder's measurements, but if cloud lightning had only the slanting wave front he measured we would, logically, have to abandon the use of lightning choke coils. An experience is apropos. A three-layer lightning choke coil was once used in general practice. Lightning soon established a convenient shorter path through one layer of the coil by a spark which jumped across the other two layers and shunted them out of the path of the lightning discharge. Today choke coils are made with one layer.

220,000 Volts Versus Lightning Arresters

The third conclusion—that better insulation of transformers may make lightning arresters superfluous—calls for separate comments. It is still the hope that 220,000-volt transformers will naturally be sufficiently insulated to withstand any value of induced potential of lightning that may reach them. Those new high-voltage installations are in California, where lightning is relatively rare. We must, therefore, wait for future extensions.

Thickness of Insulation

Commenting on the protecting insulation: The higher the voltage, the less the current for the maximum size of transformer that can be shipped on the railroads. The less the current, the less the heat (I^2R) to be got rid of—heat generated in the wires of the coils. The less the heat to be dissipated, the greater the thickness of insulation that may be wrapped around the wires.

But what is to be done at lower voltage where the current for a given size of transformer must be greater? Is it really more economical to pay for a highly insulated transformer of low kilowatt rating or to purchase a lightning arrester as an adjunct to a reasonably insulated transformer having a high radiation of heat and a larger kilowatt capacity. Some transformers are bound to be overloaded by successive accidental short circuits and by other uncontrollable conditions of operation. While the circulating oil and the outer surface of the insulation in contact with it may be at a safe temperature, the heat gradient in poorly conducting thick insulation may at the same time maintain a high temperature at the inner surface which is in contact with the copper. If this heating effect goes far enough, the insulating qualities of the inner surface of the insulation will be deteriorated. The virtual result is thin insulation. When the insulation of power transformers is seriously deteriorated the manufacturing engineer would be pleased indeed to have no lightning arrester at the place, to avoid, as he thinks, an unjust condemnation of his arrester when transformers fail because of weak insulation. Lightning arresters are developed to protect normal insulation.

Bushings and Lightning Protection

Furthermore, assuming, tentatively, that the economics dictate more interturn and intercoil insulation and no lightning arresters, what of the bushings of transformers? Lightning causes far more flashes through the air around bushings than internal punctures. To try to solve the problem of flashover of bushings by increased insulation reduces the practice to absurdity.

Accepting a million volts of lightning potential at the height of the transmission line, shall we place bushings of 100,000-volt rating on 2,300-volt distribution transformers? The bushing is larger than the transformer. Extra pole supports would be needed. The cost of one bushing would equip all the transformers in a large district with 2,300-volt lightning arresters. The saving in the rest of the high-voltage bushings would, in financial jargon, be "pure velvet."

Electrical Conductors in Practice

It is well to note the obvious—useful electric power is not distributed in the clouds or by means of the clouds. The object of this remark is to call attention to the equally obvious—that power is transmitted by wires, and it is the lightning phenomena in the wires, not clouds, that are of vital importance to the industry.

Atmospheric Conduction Speculations

Setting aside for a time any thought of Dr Norinder's work, a detour at high speed will be made over dangerous ground, namely, the fascinating problem of power transmission without wires. Far be it from the writer's intention to state that some day power will not be distributed over the earth above the clouds by utilization of the high electrical conductance of the upper atmosphere. The proposition contains some attractive figures. For example, the distance up to universal conductance all around the 25,000-mile circumference of the earth is only a few miles, while it is 3,000 miles from San Francisco to New York. The outer conducting envelope of the earth might be fed with electrical energy at any number of points where huge hydraulic power is being wasted and suitably tapped anywhere in civilization where it can be utilized. Immediately there flashes forward the great advantage of using in New York and Chicago the waste power pouring over Victoria Falls, Africa. Attractive the thought, also, to save millions of tons each year of the limited supply of the world's coal. "Why not?" asks the dreamer. "Aren't the flying machines proposing to take along a supply of oxygen for the pilot's consumption and to utilize the rare upper atmosphere for rapid transportation? Why not use the layer just above for electric transportation?" With no taint of secretiveness, we refuse to answer the dreamer's question (upon advice of engineering counsel). We prefer to follow the fore-

sight of F. G. Baum in his superpower system of wires near the earth's surface in spite of the thousands of miles of wires it involves.

Two Objects

The foregoing paragraphs may have an element of scientific facetiousness not intended. Nevertheless, there is a close connection between the subject of atmospheric high conduction and direct strokes. The desire is double-barreled—the first barrel is to bait an encouragement in the study of lightning phenomena in its most interesting phase, the highly conducting stream; the second is to point out how little we know of it.

Who knows but that a study of the lightning bolt which travels miles through an insulating atmosphere may not reveal a method of reaching the conduction of the upper atmosphere? Stranger things have taken place in research. As practical matters stand now, A. B. Hendricks has reached two million volts in designs of power transformers. How many more million will be necessary to reach from a super-Eiffel Tower on a mountaintop through a captive balloon to a high conducting layer? Incidentally, an oscillator at a half-million volts will send out luminous conducting streamers longer than one's arm, which waves around in the air and ends, not in a conductor, but apparently in invisible nothingness. It is startlingly suggestive.

Pulling the trigger of the other barrel, the object is to emphasize the fact that none of us who have made researches, not even the venerable Franklin, has measured what is going on in the hot part of the thunderclouds. Lodge, Thomson, Steinmetz, Wurtz, Ryan, Bedell, De Blois, Thomas, Neall, Osgood, Clay, Hendricks, Hayden, Roper, Whittlesey, Sprong, Slepian, Atherton, Faccioli, Peek, Norinder and others—all these investigators have studied what is going on in transmission circuits, or in laboratory circuits, or in antenna circuits, or in mathematical circuits. These activities are non-lethal and fittingly proper. After all, the foremost problem is the transmission by wires of useful electric power without interruption by the effects of cloud lightning. But one may question the fitness of making a limited number of tests on short damped antennas at considerable distance from bolts of lightning and concluding with recommendations, that no other phenomena than the ones measured take place on an undamped transmission line, which is sometimes actually struck by lightning and still more frequently nearly struck. The place to study the effects of lightning on transmission lines (and thereby recommend good practice) is on transmission lines, not antennas. Even so, those of us who have devoted a score of years to this study feel a modesty regarding the absolute correctness of our recommendations and the need of changes as experimental data and practical experience indicate the unsoundness or incompleteness of our theories. On sufficient evidence we stand ready, momentarily, to recommend a reversal of the best established American practice. But the evidence must first be forthcoming and must overpower much convincing evidence collected during the past twenty years.

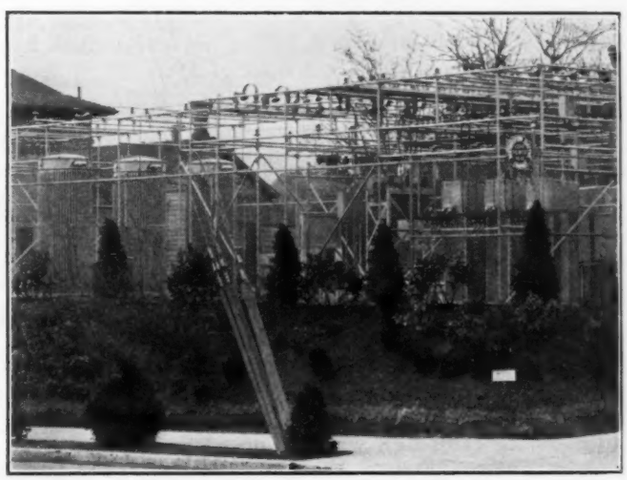
American Experience and Practice

Our experiences give the matter a national aspect. Each season there are thousands and thousands of lightning discharges of absolutely harmless nature which take place through lightning arresters. That is a matter of incidental interest. However, if we conclude therefrom that arresters have no place in the economic problems of electric transmission we blink some important facts. The impelling interest is focussed, not on the thousand harmless lightning surges but on each destructive stroke—not on the thieves who do not break through the door of insulation but on the fellow that dynamites the door and steals the continuity of service. The relatively rare stroke is the one that produces the problems the protective-apparatus engineers are still wrestling with—study of phenomena, of preventive measures, of cures. So long as the preventive measures are ineffective we know nothing better than to recommend the restricted and limited use of the best lightning arresters that can be produced.

The economic problem of lightning protection cannot be solved by conclusions drawn from but one factor. The future of the development is still the future. The present calls for lightning arresters in some locations and none in others. The American engineers of power transmission, in their gradually increasing endeavors to render more perfect service, are demanding more arresters and more of arresters.

While some of the briefly expressed conclusions affecting protection of electrical apparatus find us in disagreement, this does not lessen the appreciation of the valuable research work, of the highest quality, performed by Dr. Norinder.

Unit-Type Outdoor Substation for City Distribution



OUTDOOR substations of the unit type with an ultimate capacity of 6,000 kw., such as that shown in the accompanying illustration, are used by the Northwestern Electric Company, Portland, Ore. A number of stations of this type with a capacity of 3,000 kw. and equipped to handle four outgoing feeders of 800 kva. each are to be installed.

Each feeder is equipped with an outdoor-type induction regulator. The stations are supplied from an 11,000-volt ring feeder and all outgoing feeders are three-phase, 2,400 volts. The ring feeder will be fed at intervals from a 66,000-volt circuit. Both the 11,000-volt and the 2,400-volt circuits are protected by outdoor-type oil circuit breakers, and all circuits to and from the station are installed in lead-covered cable.

In order to combat the intensive load conditions which are coming on rapidly it is planned to install one of these stations for each square mile of the territory served as fast as conditions warrant. The stations will be beautified through shrubbery and landscape.

The Wausau "White-Bag Campaign"

Story of an Ingenious Residence Survey and Appliance Campaign that Resulted in a Sale Averaging $40 for Every Customer and Greatly Benefited Public Relations

By E. V. PRYOR*

THIS article from the central-station company at Wausau, Wis., is one of the most inspirational and interesting stories of central-station residence survey work and appliance selling that have ever been published. It is of particular importance at this time when the industry is considering plans for a general survey of household installations. The Wausau campaign had three objectives—first, to tell the housewife how to renew a fuse, read her meter and check her bills and carry to her a message that would improve public relations; second, to obtain a record of the appliances in use and, third, by an ingenious sales approach, to arouse interest in other appliances and make sales that would both finance the survey and add to the load. Sales were not solicited during the survey, but the total was astonishingly great. A regular sales campaign followed. It should be exceptionally valuable experience to other companies that are planning to survey their residence customers.

SOME TIME ago an exceedingly successful residence survey was conducted in the territory served by the Wisconsin Valley Electric Company in central Wisconsin, embracing the cities of Wausau, Merrill and Stevens Point and a number of neighboring villages. The combined population of the communities covered by the survey is 42,000—20,000 in Wausau, 9,000 in Merrill and 13,000 in Stevens Point—with a total of 9,700 residence meters in service. In a house-to-house canvass to these consumers lasting five months and in an appliance selling campaign that followed for six months more a total of $360,000 in appliances and wiring was sold, which is, roughly, $37 per consumer for the three communities—an unusually large total in comparison with other recorded experiences.

The first objective of the canvass was to better public relations, and this thought dominated. At the same time it was believed that it would be valuable to secure a survey of residence conditions, and also provision was made to sell such appliances as the customers desired to purchase, through the canvassers, although no one was asked to buy until after the canvass was completed, when a straightforward appliance selling campaign was put on. The Wisconsin Valley Electric Company decided to organize this survey into what it called a "white-bag campaign," which was devised as an ingenious method of gaining public attention and a welcome into the home.

In working out a successful plan for reaching the homes it must be remembered that the average housewife is very wary of the house-to-house canvasser. She is hardened to the frequent word attacks of the book agent and the utensil solicitor, and she pays scant attention to his call. A man carrying under his arm a leather package or a sample case is at once judged to be an agent by the housewife, observing him from within the house, and his chance of gaining an entrance or even an interview after being so classed is slim.

It is conservatively estimated that 60 per cent or more of the ordinary house-to-house canvasser's time is spent on the outside—more than half of his salary and commission is paid for his efforts to gain an entrance. When he succeeds in getting into the house it is often through a ruse and against the wishes of the housewife. As a result he must use still more of his time to overcome the antagonistic feeling thus aroused before he can begin his actual sales canvass. But for the "white-bag man" it is an entirely different story.

The idea of the "white-bag campaign" was formed in 1921, when times were hard out in this agricultural country and salesmen complained that they could not get business. Something had to be done to put human interest and enthusiasm into the selling of electrical appliances. We took the idea to Chicago one day to an artist and with his help developed advertising displays beginning with a series of "teaser" announcements featuring simply a white valise, first small then large, and then a man carrying a white bag, and then the slogans "The White-Bag Man is coming," "Watch for the White-Bag Man," "The White-Bag Man is coming to your house," and so on through a series that was to run daily for the first week, starting small and working up to full-page space, then gradually slowing down to three insertions a week.

For the success of the "white-bag campaign" depends in a large measure upon the way in which the "white-bag men" are introduced to the community. When the "white-bag" advertisements began to appear people didn't know what it was about. Some thought it was a play, a book, a soap. Some people we heard of cut the pictures of the bag out of the paper, thinking they might have a premium value. Then when the announcement came that the "white-bag men" were coming from the Wisconsin Valley Electric Company to tell the housewife how to read her meter, how to renew a fuse, how to check her bills, and so on, women began to call us on the telephone asking when the "white-bag man" would call, in some cases saying that they would be away a few

*Since the writing of this article Mr. Pryor has resigned from the Wisconsin Valley Electric Company to become a special field sales manager for Altorfer Brothers Company, Oakland, Cal.

days and not to let him come till they returned. It was the talk of the town.

SELECTING SALESMEN

Meanwhile, of course, we organized our selling crew of six "white-bag men." Until two days before the announcement was published these men did not know what the plan of the campaign was, so eager were we to keep the plan a secret from the public. We organized our crew largely of out-of-town men, for it has been proved, particularly in cities under 25,000, that out-of-town men will produce better results.

The out-of-town man, regardless of age, is looked upon as an expert in his line, and he receives close attention, while the local man, if young, is remembered and looked upon as a boy and considered too inexperienced to give advice. The out-of-town man never hesitates to close a sale in the shortest possible time, while the local man, when working among friends and acquaintances, is reluctant to close immediately and is often too easily put off with, "I'm going to buy some time, John, and I'll surely remember you."

WHITE-BAG EQUIPMENT

In order to identify the "white-bag man" with the newspaper advertising, we selected bags similar to the one shown in the advertisements. A 20-in. bag has proved the most practicable in size as it is large enough to accommodate several appliances without in any way suggesting a sample case. We used black or brown bags, to which was given a coat of flat white paint. The bags were equipped with a percolator, a table stove or waffle iron, an upright toaster, a warming pad and a curling iron.

Judgment must be used in the selection of the type of appliances as well. One of the most common and injurious impressions held by the public is that all electrical appliances are extremely high in cost. For this reason we found that it is better to use a plain pot-type percolator, nickel-plated, in preference to a panel-type or urn-type percolator. Just as many of the higher-priced percolators will be sold, while the sale of the cheaper one will be doubly increased.

The following items completed the equipment: One box of fuse plugs, "How to Read Your Meter" cards, order book catalogs (not over two) of the various appliances stocked. The price book should be an indexed ring binder, giving prices on all appliances stocked, their wattage and the maximum time allowed for payment.

COMPENSATION

The matter of compensation was extremely important, for one satisfied salesman is worth ten dissatisfied men. Each "white-bag man" was paid a salary of $100 a month. A sales bogey was placed at $50 per working day. On each sale in excess of this amount he received a commission of 5 per cent. Since the month will average twenty-six working days, this meant that a salesman was obliged to sell $1,300 worth of appliances before drawing any commission. To provide additional inducement and enthusiasm, the man bringing in the greatest number of orders for each day received an additional 2 per cent bonus on the total amount of business brought in by all the "white-bag men."

EFFECT OF BONUS

This bonus brought excellent results. If a man had demonstrated higher-priced appliances during the day and found he was running short in the actual number of appliances sold, he would bend his energies at once

He Has a Message for You
Profit by his Information and Instructions
Hear His Message
Watch for the White Bag Men!
They Will Call At Your Home
—and at every electrically lighted house in the city.
Their message will be one of service—their advice will bespeak of economy—and your knowledge of electricity and its terms will be increased manyfold.
Has He Called on You?
Every Electrically Lighted Home in the City will be Visited
Ask the White Bag Men!
Watch for the White Bag Men. Their Service Will be Well Worth the Time You Give Them.
-Wisconsin Valley Electric Company-

AFTER THE "TEASER ADVERTISEMENTS" CAME A SERIES OF FULL AND QUARTER PAGE DISPLAYS IN THE NEWSPAPERS TELLING WHO THE "WHITE-BAG MEN" WERE AND WHAT THEY WERE GOING TO DO THAT AWAKENED LIVELY INTEREST

to making some quick sales of low-priced appliances. This tended to hold down the time given to washers and cleaners to produce more sales of smaller heating devices. The effect on the men was stimulating. The whole crew was excited at the end of the day to see who had won the 2 per cent. When a man would come in discouraged at 3 o'clock to ask if any one had reported and be told that some other "white-bag man" hold sold six appliances, out he would go again to plug away until 6 o'clock.

All sales not reported at the office by 7 o'clock were credited to the next day, so that a man could not come in the last moment and, finding that his standing was poor, go out and work all the evening trying to pull ahead. The desire to win this bonus led to a large number of sales of engine heaters, immersion heaters and other unusual devices that build good load yet receive little public attention and need much of the average salesman's time.

How the Crew Worked

On the day on which the campaign was to commence the crew went out under the direction of a captain. They had received several days' intensive schooling and a "pep" meeting had been held the night before. The men were enthusiastic about the idea around which the campaign was organized. They proceeded to the districts assigned for the day. Each man had twenty prospect cards given him.

The plan was to put these men into keen competition with each other, and to prevent complaints of unequal territory it was thought not desirable to give them individual districts. Moreover, the competitive influence of working in a crew where the men were under one another's observation and results could be tallied up from hour to hour was desirable.

The prospect cards were made up from the meter books and provided spaces to fill in the number of appliances that were in use in the home, appliances demonstrated, sales made, with a space for a return call later. The cards were issued in the order of the meter route. The first twenty cards were given to one man, the next to another, and so on until all the cards for the day had been given out. This arrangement of keeping men in the same territory considerably facilitated the delivery of appliances that were sold day by day.

Experience proved that a salesman could not do full justice to more cards than this. Only when the percentage of "not-at-homes" ran particularly high were the districts ever covered again on the following day. It proved inadvisable to make recalls on "not-at-homes" unless they ran above 25 per cent as it meant going over the entire territory covered the previous day. After the entire city had been covered, however, by initial calls, all cards were separated and salesman A's cards were given to salesman B and salesman B's cards to salesman C, and wherever a man had failed to find "prospects" at home or been unable to make a sale, a new man was sent. This change of personality on the recall produced good results.

Method of Approach

The method of approach used by the "white-bag man" was the secret of the success of the campaign. Supported by the advertising which had the entire community on the lookout for him and armed with the white bag itself, the salesman rang the doorbell. The housewife saw at once that here was the "white-bag man," and so great was the interest that almost without exception our men had a welcome. The salesman immediately asked if this was Mrs. Smith and told her that he was the "white-bag man" come to explain things about electricity.

Attention is called to the opening remark of the "white-bag man" and the way in which he links himself up with the company and takes full advantage of the newspaper advertising back of him. "I am here,"

He Will Call On You
--and on every electrically lighted home in the city
His information will be of value to you. Your knowledge of electrical appliances, their uses, and terms pertaining to electricity will be increased, enabling you to more efficiently use this, the greatest of all servants.
What is a Kilowatt? The Will tell You
Did You Ever Stop to Consider How Utterly Impossible it Would be to Carry on Business Without the Units of Measurement?
What Is a Fuse Plug? Let the Explain
A Fuse Plug, while one of the smallest details of your electrical installation in size, is at the same time an important device and must be installed where electricity is in use. It is placed there for protection--protection to your electrical equipment and your wires.
Can You Read Your Meter? The Will tell You
HAVEN'T you often wished that you could read your electric meter so that you could know how much it cost to use a certain electrical appliance? Or perhaps you have felt that the meter was over read and you would like to be able to re-read the meter yourself?
KNOW HOW TO READ YOUR METER
Let the White Bag Man Explain.
You will find his message interesting.

THE "WHITE-BAG MAN" WAS SENT OUT PRIMARILY TO RENDER A SERVICE AND WAS INTRODUCED AS SUCH

he says, "to explain to you a few of the common terms and uses of electricity that we believe every user of electricity should know." Without allowing the interest to waver even for a moment, he continues: "Have you ever seen one of these, Mrs. Smith?" and he holds out a fuse plug for her inspection. Of course she has seen one before and, whether it was six weeks or six months ago, she remembers perfectly well the night the fuse plug blew out. And she also remembers the elec-

trician's charge for replacing it, even though he was there for only two minutes.

All of this comes back to her, and now here is a man from the electric company to show her how she can replace a fuse plug herself. Of course, she is going to let him in! And after he has shown her how to detect the defective plug and how to replace the fuse it seems only natural, while they are standing right by the meter, that he should casually ask her if she knows how to read it.

METER AND BILL

It is only a matter of a few minutes to explain how easy it is to read the meter and all the while the "white-bag man" is growing in favor with the housewife because of the service he is rendering her. She does not look upon him as a salesman—in fact, it often happens that during the conversation she will make a remark like, "I've been thinking of getting an electric percolator, but I was afraid it would make the meter go around too fast." At all calls, however, the service talk is adhered to until finished.

"And now that you can read your meter," continues the interesting "white-bag man," "do you think that you can figure your bill?" Nine women out of ten can't and they admit it—so the "white-bag man" takes the scratch pad from his pocket and seeks a chair by the dining-room table, at the same time placing the white bag within handy reach.

Figures require attention, and while he is reading his figures as he is writing them down the housewife's attention is centered on the question at hand. Her mind is free from the household duties and worries; her whole attention is given to the "white-bag man." At this point, "To make it clearer to you, we will take for example this toaster," he says, and he brings out the toaster.

HOW THE SELLING STARTS

While a few moments ago her whole attention was given to the figures he was writing, it has now changed to the handsome piece of nickeled ware that he has brought out from the bag. Attention and curiosity are now both intermingled. Curiosity oftentimes leads with a question such as this: "How much is a toaster like that?" Now, curiosity never bought a thing in its life—it seems that desire holds the pursestrings, and the "white-bag man," knowing this, answers: "Why, Mrs. Smith, haven't you a toaster? Well, if you will get me a piece of bread, I'll show you how it operates." And with that he starts to find a place to insert the attachment plug. This is done for a twofold purpose—to overcome any possible indecision to get the bread and to have the toaster fully heated by the time she returns with the bread, so as to reduce the time in toasting.

And while the bread is being toasted to a golden crisp the "white-bag man" manages to keep Mrs. Smith interested, for he realizes that to sit down to wait for the toast would make minutes seem like hours. So he calls her attention to the cord, the plug, the manner in which the heating element is placed, the fiber legs of the toaster, the warming shelf, its appearance, its usefulness, etc., and while turning the slice he calls her attention to the manner in which the toast is turned automatically.

On no occasion during the course of the survey is the housewife urged to buy. Rather her interest is aroused so that the purchase of an appliance is brought into the discussion on her own initiative.

DAILY ROUTINE

This was the routine of the campaign: Each day the crew went out with its set of cards and worked as a team all in the same district. Each day just before noon each man suggested to some housewife that he should leave the appliances with her while he went home to dinner and that she should use them in getting her own meal. Very often at the end of the day he would leave his demonstration appliances in some other home, so that every day perhaps a dozen families tried the appliances themselves. This went on for five months until the entire territory was covered.

We held nightly meetings for the first two weeks of the campaign. I made it a point to remain in the office every evening until the last man came in, to give him a welcome and show interest in what he had accomplished. Never was there a chance for a salesman to come in tired at 7 p.m. and find that nobody cared. During the day the men restricted their work entirely to the small appliances which they carried in the white bag. If they found "prospects" interested in washing machines or vacuum cleaners, they made an appointment to return in the evening, for they knew that then they would find both the husband and wife at home and the deal could be closed. The average call, they found, consumed from three-quarters of an hour to one and one-half hours, depending on whether the salesman demonstrated thoroughly one or more appliances. They are rarely in one home more than an hour, however. The men reported in the office at 8 a.m. and were in their district by 9 a.m.

RESULTS IN SALES

The actual white-bag campaign, as I have said, continued for five months. After the survey and canvass was completed the men ceased to carry their white bags, although many of them desired to continue to do so, because the bag had proved so helpful; but they spent six months in following up their prospects. This eleven months' activity resulted in a total sales as follows:

		Approximate Receipts
Washing machines	600	$90,000
Cleaners	425	29,500
Toasters	832	10,800
Flatirons	1,450	13,000
Percolators	.....	9,500
Portable heaters	650	7,000
Ranges	60	10,000
Commercial appliances such as grinders and glue pots	.....	9,400
Ironing machines, dishwashers, sewing machines	.....	9,000
Miscellaneous small appliances, such as curling irons, heating pads, engine heaters, fans, vibrators, etc.		15,000
Mazda lamps		53,000
Portable lamps, fixtures and wiring		103,500
Total		$359,700

About 90 per cent of these sales were made on the first call. Aside from the vacuum cleaners and the washing machines that were sold in the evening, practically 100 per cent of the appliance sales made were of equipment carried in the bag, the assortment being varied to suit the season. The men sold many baseboard outlets and took many orders for extensions of the wiring and many inquiries for fixtures, which were all referred to the office.

From the sales standpoint the campaign was a distinct success, but the greatest benefit has come from the better feeling that the "white-bag men" have left behind them.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Use of the Megger to Measure Insulation Resistance

To the Editors of the ELECTRICAL WORLD:

In your issue of February 9 there appeared an article entitled "Periodic Inspection, Cleaning and Testing of Alternating-Current Generators." The present writer is particularly interested in the latter part of the article, beginning at the bottom of the last column on page 289 and dealing with testing. Having had much to do with meggers and the measurement of insulation resistance for the past ten years, he feels that several comments are in order:

Whenever the subject of insulation is discussed we must bear in mind the distinction between the insulation-resistance test, which has to do with the flow of current through the insulating material, and the overvoltage test, which has to do with the ability of the insulation to stand up under static strain. The "A. I. E. E. Standards" recognize the worth of both tests and for new apparatus prescribe minimum values for each, depending upon the rated kva. and voltage of the apparatus under test. It is further prescribed that the insulation resistance test be made at 500 volts. This voltage is very frequently far below the rated voltage, but nevertheless it produces satisfactory results.

A test at 500 volts, whether made with a megger or otherwise, will not give the same value of insulation resistance as if made at some other voltage. It does, however, give a basis of comparison whereby we may know for new apparatus whether the insulation resistance is up to the prescribed value, and for apparatus in service whether the insulation resistance is high enough to justify continued operation or whether it is so low as to demand immediate overhauling of the apparatus before actual breakdown occurs. There is no necessity for knowing the true leakage current at rated voltage.

An overvoltage test should never be made on new or old apparatus without first making a measurement of the insulation resistance. If the insulation resistance is low, the source of trouble should be located and removed for the purpose of preventing unnecessary breakdown.

In the article referred to it seems to be implied that tests made with a kenotron give directly all necessary information while tests made with a megger must be interpreted. As a matter of fact, both tests carry with them the necessity for proper interpretation. A single test by any method at any voltage tells only of the condition of the insulation at the time and under the conditions of the test. Periodic tests can, however, be interpreted in the light of experience and a good idea gained as to whether the insulation is deteriorating, and if so whether it is slowly or rapidly approaching the danger point.

The megger provides the easiest and most convenient way of measuring insulation resistance. The instrument is entirely portable, rugged, requires no external source of potential, and with it accurate tests can be made by almost any person with very little experience. Many companies throughout the United States are using the megger to make tests and are unquestionably obtaining results that are worth while.

Such criticism of the megger as the author makes is undoubtedly due to his not being familiar with the instrument; otherwise he would not make reference to "the detrimental effect of the alternating-current voltage supplied by the small generator of the megger." Meggers are in all cases provided with direct-current generators.

WILLIAM B. CREAGMILE.

Philadelphia Pa.

The Central Station and the Merchandising of Electrical Appliances

To the Editors of the ELECTRICAL WORLD:

I have been reading the articles which you have been publishing under the title "Who Is Selling Electrical Appliances?" I think this is a fine idea and will probably prove a number of things which all of us have had varied opinions about. For instance: We have thought of educating the contractors to be salesmen, but these articles seem to be proving that this cannot be done. They also show the growing interest of department stores in selling electrical appliances and that they are eager to get into any business for which there has been a demand created by central stations or other interested people. I believe they will be a factor in the appliance business in the future when the way has been paved by others who have been active in the past. They realize that missionary work is necessary to bring electrical appliances into the line classified as staple goods.

I think we central-station men should welcome new agencies in the appliance field, particularly if they develop good clean competition. I believe that we shall profit by their activities, and that they will be the means of selling more electrical appliances as well as filling up the valley at no cost to us. In Providence two of the larger department stores have gone into the appliance business and are doing pretty well.

I also contend that if we lose our appliance business to the department stores it is because we are not on our jobs and deserve to lose it. But, on the other hand, if the competition is clean, it won't be a question of a loss of business, but of increased business for all engaged in it.

I believe that the central-station companies will have to father the appliance business for some years to come, and I doubt if electrical appliances as a whole will ever be put into the class of staples as they require a specialized sales force which department stores will not pay for or employ. The popular devices will always be sold by them, probably in large volume, but the central station, to my mind, will be the logical means of creating the demand. I believe that manufacturers today feel that the logical outlet is the central station and that any advantages they have to offer will be offered to central stations, as they realize that the central stations will be in a better position to do a large volume of appliance business in their cities if they are equipped with a sales organization to take advantage of the unique situation.

A. H. ALLCOTT,
Manager of the Electric Shops.
Narragansett Electric Lighting Company,
Providence, R. I.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Errors in Relay Settings Due to Phantom Load

By William S. Schmidt
Operating Department Engineer Penn Public Service Corporation, Johnstown, Pa.

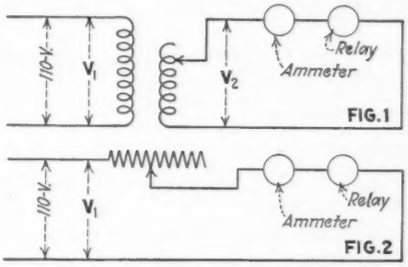
Articles have appeared from time to time describing portable relay-testing sets for setting induction-type relays. In practically every instance the load on the relay was obtained by a small adjustable step-down transformer capable of giving about 30 amp. The writer wishes to point out some of the errors liable to occur when testing relays with this type of transformer, particularly with the small home-made transformer of uncertain characteristics. While it is known that distorted wave form affects the accuracy of relays, many operating engineers do not realize that the error may in some cases be as high as 100 per cent.

The following is an actual example of the errors that occur: A relay had to be checked as to time setting with a certain load, but our testing transformer was in another district, so a phantom-load box was secured from the meter department. The relay was tested and found to be about 50 per cent faster than it was supposed to be. Other relays in the substation were tested and found to be fast by about the same percentage. This led to the supposition that the transformer was producing an error. The results not only indicated that this was true, but further showed that the phantom load was about 35 per cent to 40 per cent slow when compared with a straight non-inductive resistance load.

A spare induction relay was set up and tested, using a lamp-bank load, resistance load, meter-load box and the step-down transformer. The relay was set on tap 5, lever 5, and left untouched during tests. At least two readings were taken in each case and the average was noted. The same ammeter was used in all tests.

In the tests with the step-down transformer and the meter-load box the connections as shown in Fig. 1 were used. The time was obtained by a cycle counter not shown and is in cycles with a system frequency of 60. When resistance load and the lamp-bank load were used they were connected as shown in Fig. 2. The difference in cycles and the percentage of error compared with the lamp-bank resistance readings are given in Table I. Since the resistance load is practically non-inductive and approaches very closely the lamp bank, as shown in Table I, the resistance method of loading the protective relays was adopted as standard.

In order to check the above performance more thoroughly, oscillograms of similar tests were taken using the same relay. In the first test the stepdown transformer was connected as in Fig. 1. The oscillograph recorded the current in the relay, the primary voltage V_1 and the secondary voltage V_2, as shown in Fig. 3. The current showed a pronounced fifth harmonic, while the secondary voltage apparently had a twenty-third harmonic. The relay was set on tap 5, lever 5, with an 18-amp. load.



FIGS. 1 AND 2—ARRANGEMENTS FOR TESTING TRANSFORMERS

The next test consisted of leaving the relay settings untouched and substituting the series-resistance load for the step-down transformer. The connections are shown in Fig. 2. In this test another generator was used, and, as is noted, the primary voltage is not a pure sine wave, but is angular in shape, with a fifteenth harmonic.

The next test consisted in leaving all connections untouched as in Fig. 2, but using the same generator as

TABLE I—COMPARATIVE ACCURACY OF RELAYS USING STEP-DOWN TRANSFORMER AND RESISTANCE LOADS

Amperes	Lamp Bank, Cycles	Step-Down Transformer			Meter-Load Box			Resistance		
		Cycles	Difference	Per Cent Error	Cycles	Difference	Per Cent Error	Cycles	Difference	Per Cent Error
6	244	Very slow	...	...	474	230	94.2	254	10	4.1
7	157	510	353	225	242	85	54.1	163	6	3.8
8	121	275	154	127	176	55	45.5	129	8	6.6
9	103	216	113	109	142	39	37 9	107	4	3.9

TABLE II—RESULTS OF RELAY OSCILLOGRAPH TESTS USING DIFFERENT GENERATORS

Amperes	Resistance and Generator No. 1 Cycles	Step-Down Transformer and Generator No. 1			Resistance and Generator No. 2		
		Cycles	Difference	Per Cent Error	Cycles	Difference	Per Cent Error
17.9	62	99.0	37	59.6	76	14	22.6

TABLE III—EFFECT OF VARIOUS LEVER SETTINGS ON RELAY ACCURACY

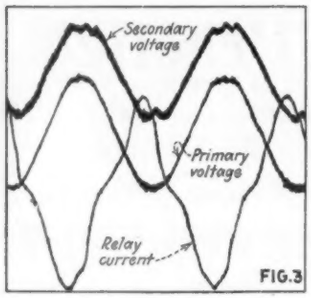
Amperes	Resistance		Meter Load Box		Error, Lever 10		Error, Lever 2	
	Lever 10 Cycles	Lever 2 Cycles	Lever 10 Cycles	Lever 2 Cycles	Cycles	Per Cent	Cycles	Per Cent
8	290	35	412	46	122	42.1	11	31.4
12	208	28	294	34	86	41.4	6	21.5
16	175	23	246	30	71	40.6	7	30.4
20	158	22	221	27	63	39.9	5	22.7

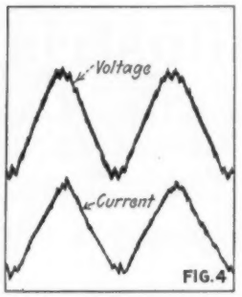
TABLE IV—TEST OF RELAY "B" USING TAP 4 AND LEVER 10

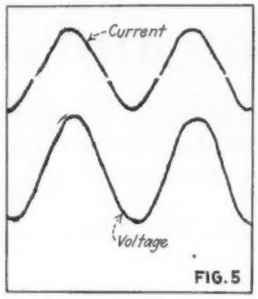
Amperes	Resistance Cycles	Step-Down Transformer		
		Cycles	Difference	Per Cent Error
8	730	958	228	31.2
12	437	634	197	45.0
16	342	440	98	28.7
20	294	384	90	30.6

TABLE V—TEST ON RELAY "C" USING TAP 4 AND LEVER 10

Amperes	Resistance Cycles	Step-Down Transformer		
		Cycles	Difference	Per Cent Error
8	197	205	8	4.06
12	146	170	24	16.40
16	127	148	21	16.55
20	119	142	23	19.30







FIGS. 3 TO 5—RELAYS TESTED WITH TRANSFORMERS SHOW A DECIDED WAVE DISTORTION

used when the first oscillogram was taken, with 18-amp. load. The result is shown in Fig. 5. The results of these three tests are shown in Table II.

Table III gives the results obtained by using various lever settings, while Table IV shows results from relay "B" and Table V results from relay "C."

Some types of relays are not affected as much as indicated above, but in order to guard against any possible error due to distorted wave form, non-inductive resistance loading should be used in relay testing.

Increasing Circuit Capacity

Tests to Show Value of Shifting a Two-Wire Conduit System Into the Three-Wire Form—Results Unsatisfactory for 100 per Cent Unbalancing

DEFINITE engineering data on the effect of trying to shift a two-wire conduit system into the three-wire form for increasing the capacity of two-wire circuits are lacking, and to find out exactly how this situation would work out in practice the standardizing and testing departments of the Edison Electric Illuminating Company of Boston made a series of tests. The tests comprise voltage measurements on three-wire circuits under varying conditions of balance, made over from two-wire circuits, running in ordinary iron conduit or BX cable by the addition of a third external wire. One pair of No. 8 solid wires was run for a distance of 50 ft. along the floor on standard wiring cleats. A second pair in BX armored cable was run the same distance, parallel to and 18 in. from the nearest cleat wire. A third pair of wires was pulled into 50 ft. of ½-in. iron conduit, which was laid 18 in. from and parallel to the BX. Drop points were established at each end of each wire and were placed so that the resistance of the various wires between the drop points was approximately the same.

Various combinations of three wires were chosen from the six available wires and connected up to imitate a three-wire 220-110-volt alternating-current circuit, one side being loaded to a constant maximum load of 35 amp., the current in the other being varied from zero to the same maximum. Under these conditions measurements were made of line and voltages and for certain cases of the drops in the individual wires. The line and load voltage measurements were made with two voltmeters, the line drops with a reflecting astatic dynamometer connected as a voltmeter. Adjustable resistances were used for loads.

The results of the test fall into two classes—(1) with the outside wires in the conduit and the neutral one external, and (2) with one outside wire and the neutral in the conduit, the other outside wire external to the conduit. The former class was characterized by a wide divergence of the voltages for both wires, the latter by wide divergence at certain loads for one wire and a moderate divergence for the other. Wrapping one wire closely around the conduit and bonding a wire to the conduit helps the situation somewhat, particularly when the neutral is bonded to the conduit. The BX was useless as an added return. The reactive drop in both the conduit and the BX was quite severe and would be worse in proportion when increasing the lengths of test wires used.

TABLE I—LINE AND LOAD VOLTAGE MEASUREMENTS ON THREE-WIRE SECONDARIES

Condition			Per Cent of	Current			Line Voltage		Load Voltage		Difference		Line Drops				
1*	2†	N‡	Unbalance	1	2	N	1-N	2-N	1-N	2-N	1-N	2-N	1-N	2-N	1 Alone	2 Alone	N Alone
Cond.	Cleat	Cond.	0	34.7	34.7	0	116.0	116.3	114.8	110.7	—1.2	—5.6	....	....	....	....	....
			20	36.7	30.0	7.3	114.9	113.9	113.8	109.1	—1.1	—4.8	1.48	5.55	6.00	0.93	4.7
			33	36.2	25.0	11.9	114.6	116.5	113.3	113.0	—1.3	—3.5	1.60	4.60	5.10	0.78	3.82
			50	36.3	18.2	18.6	115.6	117.1	114.0	115.0	—1.6	—2.1	1.84	2.95	4.10	0.55	2.43
			100	34.2	0	34.2	111.5	117.3	109.4	118.6	—2.1	—1.3	....	....	....	....	....
Cond.	Cond.	Cleat	0	35.0	35.0	0	115.1	115.2	113.9	114.2	—1.2	—1.0	....	....	....	....	....
			20	35.6	30.0	6.7	114.7	115.6	112.6	115.7	—2.1	—0.1	2.16	0.39	1.94	0.46	0.23
			33	36.0	26.1	10.8	114.6	116.1	111.7	117.5	—2.9	+1.4	3.00	1.09	2.75	0.83	0.35
			50	35.2	17.6	18.5	114.4	116.5	110.3	119.5	—4.1	+3.0	4.75	3.00	2.53	4.18	0.91
			100	35	0	35	114.0	117.9	107.2	124.6	—7.2	+6.9	....	....	....	....	....
BX	Cleat	BX	0	35.0	35.0	0	114.9	114.8	113.5	109.9	—1.4	—4.9	....	....	....	....	....
			20	36.0	29.9	6.8	114.7	115.6	113.0	111.8	—1.7	—3.8	1.52	5.9	6.25	0.94	5.15
			33	35.6	25.0	11.6	114.5	116.1	112.7	113.1	—1.8	—3.0	1.67	4.8	5.40	0.78	4.25
			50	35.5	18.3	18.8	114.4	116.5	112.3	114.6	—2.1	—2.5	1.86	2.9	3.85	0.56	0.96
			100	35.1	0	35.1	113.7	117.5	110.9	119.0	—2.8	+1.5	....	....	....	....	....
BX	BX	Cleat	0	35.0	35.0	0	115.2	115.3	113.9	114.3	—1.3	—1.0	....	....	....	....	....
			20	35.9	30.8	6.9	115.0	115.8	112.8	115.7	—2.2	—0.1	1.60	0.75	1.36	0.95	0.20
			33	35.7	25.8	11.1	115.2	116.2	112.3	117.0	—2.9	+0.8	2.38	0.75	2.05	0.75	0.35
			50	35.0	18.1	17.8	114.9	116.7	111.2	118.5	—3.7	—1.8	4.56	2.95	4.00	2.52	0.57
			100	34.1	0	34.1	114.4	117.8	109.4	121.8	—5.0	+4.0	....	....	....	....	....
Cond.	Cond.	Wrapped around conduit	0	35.5	35.5	0	114.2	114.3	113.1	113.3	—1.1	—1.0	1.16	1.16	1.16	1.16	0
			20	34.7	29.7	4.1	114.0	114.8	112.0	114.7	—2.0	—0.1	1.53	0.66	1.40	0.78	0.40
			33	34.6	24.5	8.7	113.9	115.1	110.6	116.2	—3.3	+1.1	2.42	0.64	2.14	0.54	0.29
			50	33.7	16.1	15.2	114.0	115.6	109.3	118.0	—4.7	+2.6	3.95	2.28	3.45	1.88	0.49
			100	33.0	0	33.0	113.2	116.7	106.0	123.0	—7.2	+6.3	7.3	1.58	1.58	5.30	1.11

* Heavy current. † Light current. ‡ Neutral. Resistance of each wire = 0.032 ohms.

TABLE II—VOLTAGE CONDITIONS ON THREE-WIRE CIRCUIT WITH 100 PER CENT UNBALANCE

Condition 1	Condition 2	Condition N	Amp.	Line Volts 1-N	Line Volts 2-N	Load Volts 1-N	Load Volts 2-N	Difference 1-N	Difference 2-N
Cleat	Cond.	Sheath and cond.	10	115.8	116.7	114.7	116.7	—1.1	....
			20	115.0	116.8	112.8	117.1	—2.2	+0.3
			30	114.2	117.3	110.5	117.8	—3.7	+0.5
			35	113.8	117.5	109.8	117.8	—4.0	+0.3
Cond.	Cleat	Sheath and cond.	10	115.9	117.5	115.2	117.8	—0.7	+0.3
			20	115.8	117.8	114.3	118.2	—1.5	+0.4
			30	114.4	117.1	112.4	118.3	—2.0	+0.6
			35	113.1	117.1	110.4	118.1	—2.3	+1.0
Cond.	Cond.	Sheath and cleat	10	115.0	116.7	113.5	117.9	—1.5	+1.2
			20	114.6	116.9	111.4	119.1	—3.1	+2.2
			30	113.9	117.2	109.4	120.5	—4.5	+3.3
			35	114.4	117.8	109.4	121.8	—5.0	+4.0

The tests rather conclusively indicate that if 100 per cent unbalancing in either wire is to exist, the results are unsatisfactory. The results of the tests are given in the accompanying tables.

Substation Inspection Minimizes Outages

ONE of the pieces of low-tension equipment in a substation that are often neglected, particularly when installed in substations scattered over a transmission system, is the low-tension oil switch. Operating mechanism, contacts, oil and the supports need careful attention if the switch is to function properly and prevent unnecessary service interruptions. Wiring is easy to neglect and is often a source of serious trouble. These and other items are covered in the following maintenance schedule, which the Texas Power & Light Company has found necessary if good service is to be maintained and serious and unnecessary interruptions avoided:

LOW-TENSION EQUIPMENT

Wiring:

Quarterly—Inspect, noting particularly that all accessible live parts, such as current and potential transformers, connection lugs and oil-switch terminals are insulated either by taping or fiber board. The insulating of switch terminals is of particular importance in that we have experienced many short circuits due to rats, snakes, etc.

Thirteen Weeks—Low-tension insulators and supports. Inspect and clean.

Switchboard:

Annually—Panel supports (oil-switch pipe and panel supports and operating mechanism). Tighten and paint with graphite paint.

Instruments (relays, oil-switch handles and trip coils). Paint if necessary with eggshell paint.

Quarterly—Nameplate card holders. Inspect, noting particularly that all oil-switch handles and voltmeter receptacles are provided with a card holder indicating circuits controlled and that all card-holders are provided with correct typewritten cards.

Monthly — Panel and instruments. Test and wipe. If panel is slate, clean first with soft rag sprinkled with transil oil, and polish with clean soft rag.

Oil Switches:

Annually — Low tension. Internal inspection of, paying particular attention to condition of contacts and condition and level of oil. Change oil if necessary.

Semi-annually—Low-tension tripping mechanism. Test by blocking the switch and raising the plunger by hand until the toggle releases. Mechanism should work freely enough for the toggle to trip when the plunger is raised with one finger. Test bell alarm.

Low tension relay. Test and oil with neat's-foot oil and record date in relay cover. Inspect contact and mechanism.

Switches (Ammeter):

Annually—Examine, clean and test for closed circuit on all three phases. Oil and renew contacts if required.

Potential Regulators:

Three years—Completely dismantle for internal and external inspection, paying particular attention to upper and lower bearings, clearance between rotor and stator. Change or filter oil. Paint motor winding and note condition of bearing.

Quarterly — Relay switch (general inspection). Oil bearing and grease gears.

Monthly—Check oil level.

Lightning Arresters:

Annually — Multigap. Inspect for burned gaps and broken resistances; note ground connection.

Transformers (Instrument):

Annually — Paint with air-drying varnish.

Transformers (House Service):

Three Years—Internal inspection; change oil.

Drainage Transformer:

Three Years—Internal inspection; filter or renew oil.

Drainage Coil:

Semi-annually—Examination of connections, fuses and switches.

Instruments:

Annually—Paint all exposed metal parts if necessary with eggshell paint.

Biannually—Test and calibrate.

Neutrals:

Annually — Current and potential transformers. Check to see that they are separate and separately grounded.

Street-Lighting Equipment:

Annually—Time switch. Examine clock and operating mechanism. Clean with gasoline and oil with clock oil; adjust the contacts and tighten all leads; change oil.

Constant-current transformers and arc sets. Clean and examine tank or cases, coils, dashpots, counterweights and flexible leads, and adjust mechanism. Inspect Dossert connectors for good contacts. Paint coils with air-drying varnish if necessary, at least once every two years. Adjust counterweights for proper current; oil bearing. Check stops governing range of movable coils. Test cooling coils in tube tanks. Clean tubes. Change or filter oil if necessary.

Constant-currrent cases and transformers. Inspect case and ground connection; paint with graphite paint.

Station Apparatus:

Monthly—Test and clean.

Battery (Telephone):

Quarterly—Test and renew if necessary.

Lighting:

Quarterly—Substation. Clean and examine switch cabinet, fuses, globes and shades, renewing if necessary. Note particularly if all are properly fused and spare fuses provided in cabinet. Renew and repair wiring if required. On structures examine wire cage and ground at each outlet. Use 124-volt carbon lamp only.

Device Reduces Upkeep of Street-Lighting Units

BY R. H. RYAN
Eastern Manager King Manufacturing Company, Chicago

AS SHOWN by recent installations, it is only a matter of a very short time when ornamental street lighting will predominate in every city, and because of this fact the best and most efficient method of handling globes, canopies and auxiliaries for the trimmer when he is renewing the electrodes or lamps must be considered. The accumulation with time of dust and dirt reduces the initial standard of illumination in marked degree. A curve of the relative depreciation of candlepower due to dirt and depreciation is shown in Fig. 1. This curve is based on data obtained from the Illuminating Engineering Laboratory of the General Electric Company and is for light-density opal glass. The accumulation of dirt and dust on the globe cuts down the light materially. In practice it is found that many companies do not maintain the standard of illumination; that is, they do not

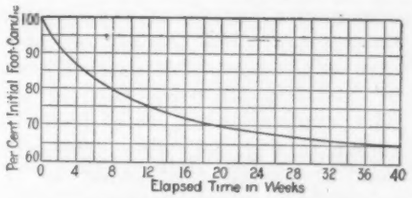


FIG. 1—STREET ILLUMINATION DEPRECIATION DUE TO THE COLLECTION OF DUST

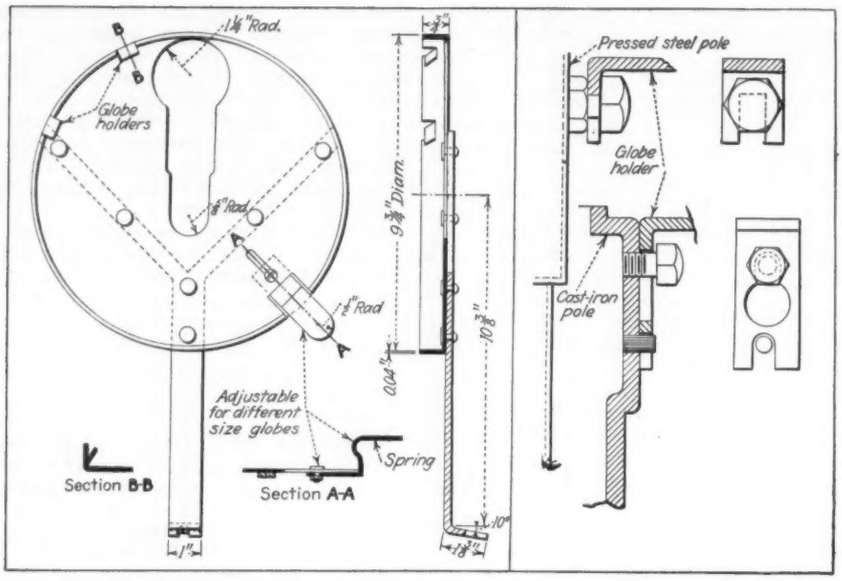


FIG. 2—DETAILS OF LABOR-SAVING DEVICE FOR AIDING LAMP TRIMMERS

keep the globe equipments or their standards clean. It is believed that in large measure the trouble lies in the facilities that are now available for handling globes, canopies and auxiliaries.

A labor-saving and time-saving device for lamp trimmers has been developed and is shown in detail in Fig. 2. This can be used for practically all types of globes and canopies. There is a bolt placed on every ornamental pole standard to receive this device, the size of which is so small that it does not mar the ornamental feature of the standard in any way. The bolt can either be cast on the pole when manufactured or installed on poles now in use. The application of this device is shown in Fig. 3A, where the trimmer is placing the device on the ornamental standard ready to receive the canopy and globe. Fig. 3B shows the canopy taken off the unit and placed on the attachment, while Fig. 3C shows the canopy auxiliaries and globe removed and supported by this device. The metal cap that is used on the top of the globe with luminous-arc lamps is laid first on this device and then the globe is placed over it on the support. These are the natural steps taken when the trimmer renews the electrodes or lamps on ornamental standards.

This method of handling globes, canopies and auxiliaries when renewing electrodes or tungsten lamps on ornamental standards should be the means of materially reducing the maintenance of ornamental street-lighting systems and of helping to sustain the high initial standard of street illumination—for which the illuminating engineer is striving.

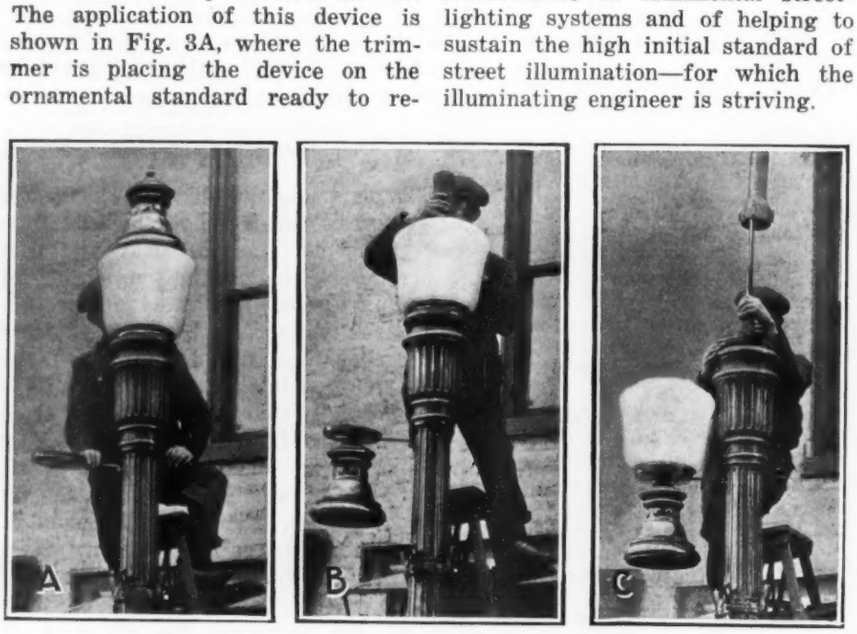


FIG. 3—METHOD OF HANDLING GLOBES AND AUXILIARIES WHEN RENEWING ELECTRODES OF LAMPS

Dayton Company Policy on Tree Trimming

BY O. H. HUTCHINGS
Vice-President Dayton (Ohio) Power & Light Company

THE problem of obtaining and retaining ample clearance between the transmission and distribution lines of a public utility and the shade trees owned by an individual seems to become more troublesome each year, owing to the continued growth of the trees and the way in which they are cherished. The Dayton Power & Light Company in its extensive operations throughout southwestern Ohio has encountered its share of trouble but has always endeavored to meet the situation in a way that would be entirely satisfactory to the owners of the trees along its distribution lines and transmission-line right-of-way. To remove any action on this situation from the jurisdiction of individuals in the company whose actions were not always those which the company could support, a careful study was made by the company's distribution engineers, who prepared certain definite instructions on tree trimming. These became effective early this year. The instructions are reproduced herewith in the hope that a certain amount of constructive criticism from the rest of the industry may follow their publication.

TREE TRIMMING

As a rule property owners are skeptical of tree trimmers. This attitude can be overcome only by years of careful work. One mistake stands out as a glaring example to many people. Tree trimming or cutting must never be done unless the permission of the property owner or legal agent is obtained, and all work must be done to his satisfaction. In many cases where specific instructions are received by the person who obtains the permission it will be necessary to label all trees under consideration by using small brass tags of the type used for numbering transformers. These labels should state whether the tree is to be cut down, trimmed or topped, and additional information as to what trimming or how low the tree may be topped should be given to the tree-cutting foreman in writing.

All tree trimming must be done under the supervision of the person who obtained the permission or his written and personal instructions (personal instructions must be given on the job). All trash must be promptly removed and burned or disposed of as requested by the owner. In the city of Dayton, on city property, tree trimming is done under the supervision of the city forester.

In making rules for tree trimming

due consideration must be made for voltage, character of construction, importance of the line, type of tree with respect to the foliage and bending conditions under storm. With secondary lines (110-220 volt alternating current) trees should be trimmed not more than is necessary to permit the stringing of wires. Bare secondaries should not be strung through the trees.

HIGH-TENSION LINES

On 2,200-volt lines and large-capacity arc circuits trees should be trimmed not more than is necessary to prevent the 2,200-volt lines being in continual contact with the trees, or in case of storm to prevent the swinging together. In many cases tree wire can be used to good advantage. Special construction with side arms, etc., must be used where possible to avoid the trees and thus obviate the necessity of tree trimming.

Trees on all 6,600-volt main feeders from the Millers Ford plant or from the substations where large capacity is involved should not be permitted to come in contact with the 6,600-volt line. Consideration of the location of the lines so as to avoid trees is extremely important. A special construction with large-capacity lines is difficult. It is not imperative that large trees be overbuilt or trimmed back to the point that they can be overbuilt. Stringing of wires opposite large limbs so that they cannot swing into the line is good construction.

On the 6,600-volt rural lines, where the cheapest construction is desirable and where capacity is lacking, it is not necessary to overbuild the trees. The use of side arms and the trimming of trees on one side so as to string the wires opposite the limbs is good construction. Spreading the conductors to prevent short circuit of the line in case of limb breakage is recommended.

On new jobs where it is a case of overbuilding growing trees poles should be installed at least 10 ft. higher so that the wires will be 10 ft. higher than the height to which the trees stand or to which they are trimmed. This will avoid incessantly annoying our customers by asking for trimming privileges.

As a rule, 14,000-volt lines are built on unimportant roads and private rights-of-way. Special construction should be used in the matter of side-arming, but in all cases the wires must be clear of the trees to such an extent that the trees during a heavy windstorm will not swing into them.

It is the intention of the company to build 33,000-volt and 66,000-volt lines on less important streets and roads and on private rights-of-way. The tree clearance should be such that the lines either overbuild the trees at least 10 ft. or that there is sufficient distance from them so that broken branches will not fall into them. Trees that measure in height more than their distance from the lines should be cut or trimmed back to a point where their height will be less than their distance from the lines. Elevation must be taken into consideration. In many cases higher poles should be installed.

Overhead Distribution Construction

Standardized Practice as Developed and Used by the
WEST PENN POWER COMPANY, PITTSBURGH

Conductors for Overhead Lines

Material.—All primary and secondary conductors shall be of copper wire. In general, all insulated wire shall be triple-braid weatherproof (T.B.W.P.). All bare and insulated wires for line work shall be medium hard-drawn except for a few special cases hereinafter specified. No. 8 wire for service drops shall be soft-drawn. All wire No. 2 and smaller shall be solid; No. 0 and larger, stranded. In general, bare wire shall be used for primaries outside of borough limits. In all other cases insulated wire shall be used.

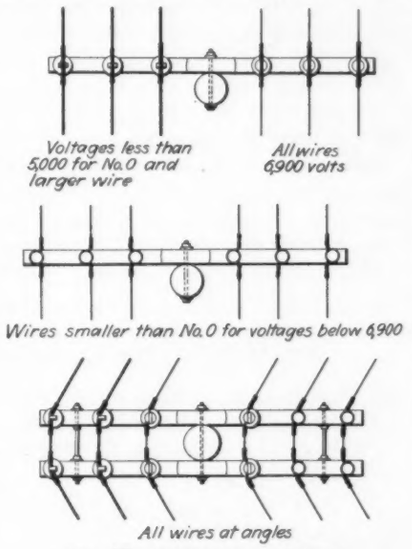

Voltages less than 5,000 for No.0 and larger wire
All wires 6,900 volts
Wires smaller than No.0 for voltages below 6,900
All wires at angles

FIG. 32—POSITION OF WIRES ON INSULATORS

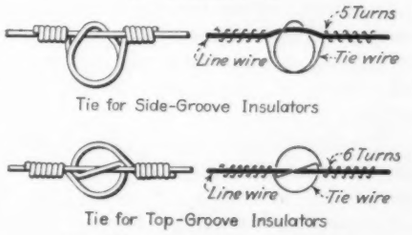


FIG. 33—TIES AND TIE WIRES

Size.—The following sizes shall be considered standard: B. & S. gage No. 8, No. 6, No. 4, No. 2, No. 0 and No. 4/0. No wire shall be used smaller than No. 6 for line work or smaller than No. 8 for service drops. Larger wire must be used whenever necessary.

Support.—Line wires except secondaries shall be carried upon standard insulators and cross-arms and not on wooden or metal brackets. As an exception to this, series street-lighting circuits may be carried on metal pole-top pins, Pierce No. 3013 or equivalent, on roads where there neither are nor are likely to be primary circuits and where the capacity of the street-lighting transformer is 10 kva. or less, if (a) this method is necessary to obtain clearance on existing poles carrying telephone or other foreign circuits, or (b) only one side of the circuit is along the road. Secondary line wires shall be carried upon vertical racks with standard rack insulators.

Attachment to Insulators.—With all 6,900-volt wires or wires of higher voltage and with all wires rated No. 0 or larger top-tie insulators are specified. In each of the above cases the wire shall be attached to the top of the insulators on straight portions of lines. At angles or corners the wire shall be attached to the sides of insulators and always on such side that the strain will come on the insulator and not on the tie wire, as shown in Fig. 32.

With all 4,000-volt wires or wires of lower voltage, where the wire is No. 2 or smaller, side-tie insulators are specified. In these cases on all straight portions of lines the attachments shall be as follows: The wires on the pole pins shall be on the side of the insulators away from the pole; all other wires on the arm shall be on the side of the insulator nearer to the pole. In the same cases at angles or corners all wires shall be put on such side of insulators that the strain will come on the insulator and not on the tie wire, Fig. 32.

Line wires shall not be attached to trees or buildings except in rare cases where no other means of support is practicable.

Ties.—All ties shall be made with wire of the same material as the line wire and shall be soft-drawn. The wire shall be cut as needed for the work, either from new wire or from short lengths of good-quality second-hand wire. No tie wire shall ever be used the second time. Ties shall be made as shown in Fig. 33. For ordinary strains use No. 6 side tie for No. 6, No. 4 and No. 2 line wires and No. 4 top tie for No. 0 and larger line wires.

Cost of Installing Rectifiers

SUBDIVIDED costs of installing one seventy-five-lamp and two seventy-five-lamp rectifiers in a Massachusetts central station from the company's recently compiled data sheets are printed herewith.

INSTALLATION OF ONE SEVENTY-FIVE-LAMP RECTIFIER UNIT

One seventy-five-light rectifier set	$2,806.00
Six bus supports	32.04
Twenty-four cable supports with fittings	14.04
103 ft., 1¼-in. block steel pipe	10.68
Four rectifier tubes	92.00
Two potheads	9.10
Miscellaneous	46.66
Labor	252.81
Total cost for one unit	$3,263.33

INSTALLATION OF TWO UNITS ON ANOTHER JOB

Cost of seventy-five-lamp rectifiers, complete sets	$5,612.00
Miscellaneous	168.26
Labor	514.89
Total cost for two units	$6,295.15

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Careful Collections Improve Customer Relations

AFTER making a careful study of collection methods and routine as practiced by a number of central-station companies, the customers relations committee of the Commercial National Section, N. E. L. A., Harold Wright, chairman, has issued a proposed schedule for collections, shown in the tabulation below, which has been found practical by a number of companies. It is pointed out that prompt-paying customers are one of the utility's best assets because prompt payment indicates satisfaction. Companies, however, should be particularly careful to perform their part in the prompt presentation of bills, and proper addresses, correct spelling of names and data as to meter indexes, consumption and dates when consumption is charged for plainly written. If discounts for prompt payment are allowed, this fact should be prominently shown on the statement.

Some companies present bills to customers by having delivery made through bill delivery men or collectors, and in some suburban territories a record of 60 per cent of all bills delivered personally by the collector are paid on presentation. This method of delivering is an accommodation to customers who would find it inconvenient to come to the office to make payment.

Where the personal presentation of bills is not feasible, a mail system may be employed, and in mailing bills to customers many companies inclose self-addressed envelopes for the customer's convenience. Promptness in executing delivery of bills is important, as many customers have a set date for paying all monthly accounts, and irregular presentation of electric bills will lead to complaints and unpleasantness.

When some of these details are not adhered to by the company customers are led into careless and indifferent habits of payment of bills, and no doubt some customers are considered slow or poor pay when, through no fault of their own, they have not been periodically presented with a monthly statement.

Where misunderstanding or careless billing has left unpaid accounts upon the books, a collection clerk may offend a customer by sending a sharp notice of delinquency. Such notices often say bluntly that service will be shut off and are used as a collection scheme. They should be employed only as "shut-off" notices and used only when loss of money may occur to the company.

Cordial customer relations are sometimes severed by so-called shut-off notices, and friendships so lost are not easily regained. The question of when a shut-off notice should be used may be answered, "When the customer 'refuses to pay'"—provided the account is due and just and loss will occur to the company on that account.

Selling More Light to Storekeepers

By Performing a Consulting Service the Cleveland Company in 1923 Improved the Equipment of 297 Customers, Adding an Average of $125.38 Increased Revenue

By G. E. Miller
Sales Manager Cleveland Electric Illuminating Company

THE activity in which the lighting division of the Cleveland Electric Illuminating Company has been engaged since January 1, 1923, has produced most satisfactory results in the form of increased load and revenue.

From our experience it is possible to draw some interesting conclusions as to the nature and possibilities of this class of business. It was found generally that merchants are exceptionally responsive to the "better light" appeals, and sales effort consisted largely of showing them what it is possible to do. A great many of these merchants have simply been waiting for some one to come along who would positively state just what was necessary to give them good lighting.

The method we have used has been to take a section in the downtown territory and list every store. To each man on our list we would send a letter offering the service of the division without obligation to himself. Following up this letter we mailed at four-day intervals five commercial lighting folders prepared by the National Lamp Works. A return post card was used in the letter and in one of the folders. Ten per cent of these post cards were returned, and from the first we have been busy following up the work as outlined when a survey was originally made. In one section of the city 40 per cent were returned.

The merchants returning cards are the first to be personally followed up by our men—but the failure to return a card does not mean that there is no follow-up. The first call of our salesman is a mission more of service than of selling. He seeks to gain the confidence of the merchant by telling him the impor-

SCHEDULE FOR FOLLOWING UP COLLECTION OF DELINQUENT BILLS, AS PRACTICED BY SEVERAL LARGE COMPANIES

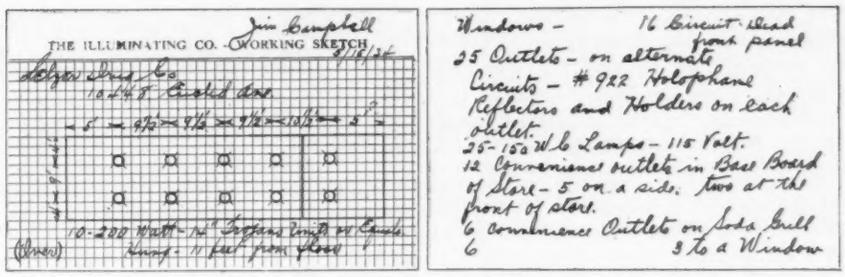
Method of Presenting Bills	Ten Days From Date of Bill	Ten Days	Twenty Days	Thirty Days	Forty Days	Days of Grace	Credit Allowance Period of Holding Account Open
50 per cent of companies mail bills 50 per cent of companies deliver bills	Discount period	Customer sent memo of arrears ten days after expiration of discount rate.	Collector calls to collect or leaves collector's notice.	Collector calls to collect or leaves a cut-off notice. Current month's bill added.	Collector calls to collect or cuts off meter.	Ten days after expiration of discount rate.	Forty days after expiration of discount rate.

tance of regularly cleaning his lamps and reflectors to get maximum service and efficiency. If the condition of the equipment shows that the merchant does not know the importance of upkeep, the salesman suggests that he be permitted to take one unit down, clean and rehang it for comparison with the others. Invariably the merchant, having read the folders that were mailed to him, asks whether his lighting is of an acceptable standard. When the answer is negative—as is generally the case—our man always has his foot-candle meter with him to back up his statements.

The method we use in a customer's establishment is to gain his confidence by using a foot-candle meter in demonstrating to him that daylight as well as artificial light can be accurately measured. A very great interest is shown by the average merchant when the instrument shows 20 foot-candles under the daylight coming in his front door and 3 foot-candles over on his counters under his artificial light. We call to his attention the proper standard of lighting: 2 watts per square foot of area and 150 watts type C lamps per running foot of show-window space.

As our representative points out the shortcomings of an existing system, he also shows how the illumination can most easily be modernized, sketching on a card, as shown in the accompanying cut, the location of the new units with the size of lamp to be installed.

The average merchant is waiting for a man to come to him and say: "This is the prescription you need for better lighting. Let us take it to a reputable contractor, just as you would take your physician's prescription to a druggist, and have it filled. It will give you proper lighting results." When the merchant gives his consent to go ahead with the work, the card is turned over to the electrical contractor who is selected to do the job. Electrical contractors here have shown a fine spirit in working with us so that the layout as made and given to the merchant will usually be installed. Of course, there were some cases where contractors at first did not feel inclined to receive our suggestions, but that is a thing of the past.


THE ILLUMINATING CO. - WORKING SKETCH
Jim Campbell
Windows - 16 Circuit Head front panel
25 Outlets - on alternate Circuits - #922 Holophane Reflectors and Holders on each outlet
25-150 W C Lamps - 115 Volt.
12 Convenience outlets in Base Board of Store - 5 on a side. two at the front of store.
6 Convenience Outlets on Soda Grill 3 to a Window
6

WORKING SKETCH SHOWING TYPICAL LAYOUT AND SPECIFICATIONS FOR LIGHTING EQUIPMENT

In analyzing the territory as it exists in a city such as Cleveland we would cut it into two divisions. One would be the downtown or metropolitan area and the other would be classed as the average outlying commercial store section. At the present time our activity covers both of these territories to an equal extent. The following figures based on our experience show the possible results in the downtown section:

Eighty per cent of the merchants on the street levels can be sold new lighting equipment and increased wattage.

Ten per cent have proper lighting equipment but will buy and install the proper-size lamps.

Ten per cent will do nothing.

Our experience in the average outlying commercial store section leads us to believe that:

Twenty-five per cent of these stores will buy increased wattage.

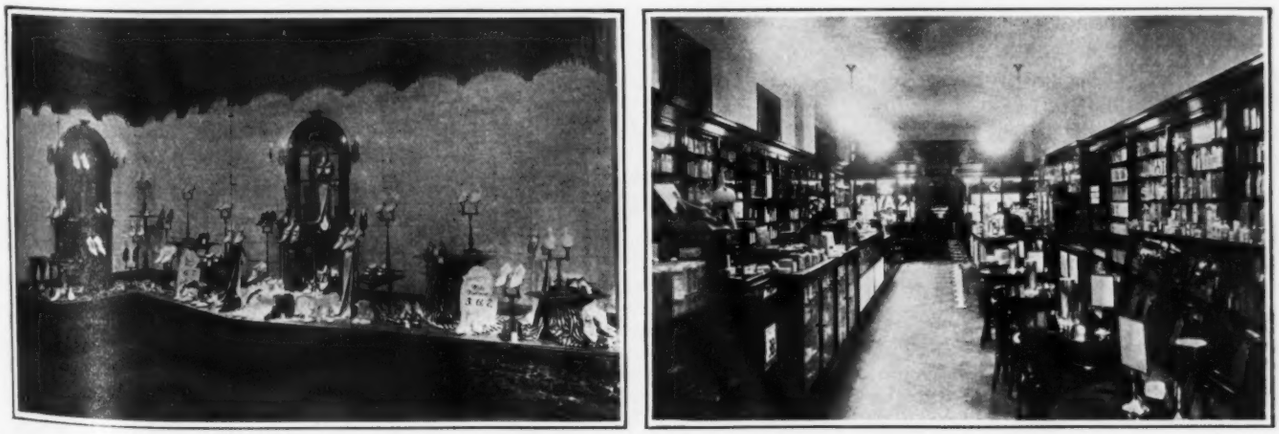
Ten per cent will buy new equipment and increased wattage.

Fifteen per cent have proper wattage in use, but the intensity is not up to standard owing to an inferior grade of glassware. This can be replaced.

Fifty per cent are in such condition financially and educationally and so affected by the question of leases and changes in surrounding territory that it is at present hopeless to try to persuade them to improve their lighting systems.

RESULTS OF YEAR'S WORK

The activity in which we have been engaged so far has resulted in 297 stores bringing their lighting up to an average of 10 foot-candles, with proper shop-window lighting averaging a 150-watt lamp for every 12 in. or 14 in. of store frontage. There have been cases where the foot-candle intensity was found to be as low as 1½, and we have places where we have raised the intensity to 18 foot-candles. The wattage increase in some cases has run as high as 10 and 12 and the yearly revenue increase as high as $1,000. Surveying the twelve months' work the following average figures are significant: An average of over $125 is spent for wiring, lamps and new lighting equipment. The average yearly revenue increase was $125.38.



TWO EXAMPLES OF IMPROVED ILLUMINATION

The average intensity of customers' illumination has been raised from 4½ foot-candles to 10½ foot-candles after the store has been relighted.

In working up these figures some of the larger relighting jobs have been intentionally eliminated so that the figures as given could be safely used as an indication of what can be accomplished in an average territory. The method which we have been using of attracting the interest of the merchant, "following up," and finally obtaining his decision to better his lighting, is simplicity in itself. Our whole activity is based on the assumption that the merchant naturally wants better lighting and that we are competent to lay out the job. Because of the use of the foot-candle meter he has a definite "yardstick" with which to measure his results. We use 10 foot-candles as the standard for interior store illumination.

FOLLOW-UP SERVICE

We make a point not to forget the merchant to whom we have sold better illumination, and a few months later a letter of the following tenor, signed by our lighting division, is sent to him:

"You are interested in securing the best results from the electricity you purchase. Twenty-five per cent of your light is wasted if your lighting equipment is allowed to become dusty, dirty or greasy. Will you not look into this matter, which is to your advantage? We feel that your interests are our interests. If you check up at least once a month on the condition of your lighting equipment, it will react to your benefit. Trusting that you will not hesitate to call upon us at any time, etc."

This year we are continuing and extending our efforts. Decided headway has been made, and the sales resistance from poorly lighted stores has noticeably diminished. For even if a merchant is wont to turn a deaf ear to the words of our lighting salesman, he cannot ignore the progressive steps of his competitors.

Relative Values of Domestic Appliance Loads

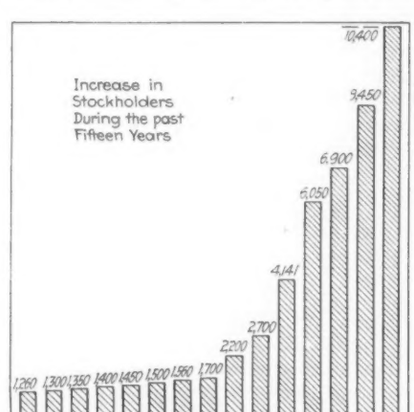
BASED on its past experience, the Central Illinois Public Service Company has prepared the accompanying table for estimating the kilowatt demand, energy consumption and annual revenue from the principal household electrical appliances.

RELATIVE DEMAND AND REVENUE FROM DOMESTIC APPLIANCES

Appliance	Maximum Demand, Watts	Annual Kw.-Hr.	Annual Revenue	Annual Revenue per Kw. of Demand
Grills	500	30	$2.72	$5.44
Toasters	500	37	2.96	5.92
Washing machines	300	25	2.00	6.67
Percolators	400	42	3.36	8.40
Irons	600	72	5.76	9.60
Ironers (electrically heated)	3,000	360	28.80	9.60
Vacuum cleaners	200	27	2.16	10.80
Heating pads	50	15	1.20	24.00
Fans	50	16	1.28	25.60
Ranges	2,500	1,500	120.00	48.00
Domestic refrigerators	300	800	64.00	213.33

Small Shareholders Control Central-Station Company

STOCKHOLDERS of the Narragansett Electric Lighting Company, Providence, R. I., represent more than a hundred different occupations and total 10,396 persons,



according to the annual report of President E. A. Barrows for 1923. The subdivision of holdings is shown in the accompanying table, the largest number of holders possessing from one to five shares each. It is noteworthy that the largest single holder, representing in excess of 4,000 shares, owns less than one-sixtieth of the property. About one customer in seven is a stockholder, and nearly half the shareholders own between four and five shares each. The number of stockholders has increased from 1,260 in 1909 to the present total.

DISTRIBUTION OF PROVIDENCE COMPANY'S STOCK

Shares Individually Owned	Number of Stockholders	Per Cent of Total Number of Stockholders	Shares Owned	Per Cent of Total Number of Shares
1 to 5	4,065	43	17,857	6
6 to 10	2,276	17	19,145	5
11 to 25	1,925	19	33,818	11
26 to 50	1,001	10	37,875	12
51 to 100	551	5	41,088	12
101 to 200	329	3	48,207	16
201 to 300	109	1	32,037	10
301 to 400	52	1	18,637	6
401 to 500	25	...	11,607	3
501 to 1,000	46	1	31,913	10
1,001 to 2,000	9	...	11,317	3
2,001 to 3,000	5	...	11,718	3
3,001 to 4,000	1	...	3,063	1
4,001 to 5,000	2	...	8,118	2
Total	10,396	100	326,400	100

What Other Companies Are Doing

Elmira, N. Y.—In order that its employees who come in direct contact with customers may know more about the company in general, the Elmira Water, Light & Railroad Company recently held the first of a series of monthly dinners which all department heads, their assistants, telephone operators and bill and complaint clerks will attend. Sixty-seven employees were present. F. H. Hill, vice-president of the company, expects to continue these meetings indefinitely.

Spokane, Wash. — During 1923 the Washington Water Power Company sold a total of 8,134 electrical appliances in the territory it serves. The gross sales value was nearly $424,000, and the business done was nearly double that of 1922. Principal among the items were 606 electric ranges, 687 vacuum cleaners, 511 heaters and 245 washers.

Providence, R. I. — With virtually no selling effort, an issue of $3,264,000 in new stock was recently sold in three weeks by the Narragansett Electric Lighting Company, 90 per cent of the issue being distributed within the state. Seventy per cent of former stockholders took advantage of the opportunity to increase their holdings, and 650 new holders were gained by the company. A total of 7,672 subscriptions was received. The cost to the company, which did not float the issue through brokers, was between 15 and 20 cents per share, against an average cost of $4 to $6 per share for many public utility stock flotations.

Denver, Col.—Two thousand kitchen-lighting units have been sold by the Public Service Company of Colorado during the first two weeks of a campaign which the company has put on. Contractor-dealers of the city are being kept busy installing the new daylight units. Holders are being furnished by local manufacturers and glassware is being furnished by one of the jobbers.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Photostat copies or English translations of complete articles will be furnished at cost upon request

Hydro-Electric Development and Steam Equipment

The 30,000-Kw. Steam Turbo-Generator at Rotherham.—The largest turbine ever made in England has recently been placed in operation at Rotherham. The unit has a rated capacity of 30,000 kw. and is designed to run at 1,500 r.p.m. The generator is wound to carry its full rated load at a power factor of 75 per cent, the current being three-phase, 50 cycles, at a pressure of 6,600 volts. The steam pressure is 200 lb. per square inch, and the temperature is 588 deg. F. The guaranteed performance is as follows:

Output in kilowatts..	30,000	25,000	20,000	15,000
Steam rate pounds per kw.-hr.....	11.4	11.1	11.4	12.0

The extreme over-all dimensions of the unit are 47 ft. 9¾ in. in length by 19 ft. in breadth by 12 ft. 2½ in. above the floor level.—*Engineering* (*England*), Jan. 18, 1924.

Superheated Steam Used Directly in Closed Heaters.—B. C. SPRAGUE.—The idea that a greater heat transfer in evaporators or closed heaters can be obtained by de-superheating the steam, rather than using it direct, appears to be prevalent. The author has under various conditions conducted many tests indicating that heat transfer is the same with both saturated and superheated steam of the same pressure, while the temperature of the tube is below that of saturation. Why heat transfers per square foot per hour should be equal is explained.—*Power*, Jan. 29, 1924.

Power-Plant Auxiliaries and Their Relation to Heat Balance.—A. L. PENNIMAN, JR.—The author discusses reliability, economy, necessity of simplicity and flexibility of operation and the balance that must be maintained in the initial outlay and the cost of fuel so as to produce power at the minimum net cost per unit, including fixed charges and operating expenses.—*Journal of A. I. E. E.*, February, 1924.

Sicilian Hydro-Electric Installation.—J. S. BARNES.—The Belice hydro-electric scheme, lately completed near Palermo, is of particular interest both from the technical point of view and from the fact that it is a typical instance of the schemes especially adapted to the peculiar conditions of southern Italy. The capacity of the draining area, power-plant features and construction of the dam are among the subjects discussed, and a description of the four turbines driving 2,400-kw., three-phase, 10,200-volt generators is included.—*Electrical Review* (*England*), Feb. 8, 1924.

Design of Surge Chambers.—P. E. BAUMANN.—The requirements of surge chambers demand that they be dimensioned in such a way as to avoid too great an oscillation of the water surface within their walls, and their function is to balance the head on the turbine or to abolish or minimize too sudden changes of head. In order to fulfill these requirements the chamber must be properly designed and its depth so chosen as to keep the bottom of the chamber when the head is at its minimum still sufficiently below the water surface. Means of determining variation of levels in the surge chambers are illustrated by a typical example.—*Canadian Engineer*, Feb. 19, 1924.

Generation, Control, Switching and Protection

Regulating Methods for Wind-Power Plants.—R. BOSSELMANN.—The author describes a mechanical speed-regulating apparatus actuated by a differential connection between the main wind wheel and a small coaxial auxiliary wheel. This mechanism operates a belt shifter between two counter-conical pulleys. Any generator may thus be driven at nearly uniform speed. To avoid a cell switch on the floating storage battery a booster dynamo is on the same shaft with the main generator. A specially designed electric regulating system is part of the new equipment, which renders the entire plant mechanically and electrically fully automatic, requiring no attendance. The described system may also be used in small automatic hydro-electric plants.—*Zeitschrift des Vereins Deutscher Ingenieure*, Jan, 19, 1924.

Efficient Operation of Surface Condensing Plant.—To obtain good results in the running of a large turbo-generator and to secure low feed consumption, a very close watch must be kept on the condensing conditions under which the unit is running. A set of records must be systematically kept, and from their interpretation much help can be obtained in keeping this portion of the plant at the maximum efficiency. The records that are necessary and that should be taken daily and entered in a log book are tabulated and discussed in detail. The problem is discussed particularly from the point of view of securing high vacuum.—*Electrical Times* (*England*), Jan. 31, 1924.

Transmission, Substations and Distribution

Power System Regulation.—The erection of the Barton generating station at Manchester (England) necessitated the construction of extensive linking-up arrangements to connect it with the rest of the system and particularly with the Stuart Street power station. The scheme adopted provides for alternative transmission routes between the two stations and the connection into the system of an important substation. A notable feature of the arrangement is its great flexibility. This has been obtained by the use of an induction regulating plant in the substation. This is one of the first installations of this kind in England where the method of pressure regulation is used on a large scale. The entire installation, the equipment and its operation are described.—*Electrician* (*England*), Feb. 8, 1924.

Units, Measurements and Instruments

Electric Meter.—M. R. FICHTER.—A single-phase induction-type meter for 110 volts and 10 amp. is described which consumes in its shunt winding only 0.25 watt per 100 volts. Its error is zero for unity power factor and only 1 per cent for 70 per cent power factor between 100 watts and 1,200 watts. The meter starts at 0.0025 of its rated current. An arrangement of one shunt coil above two series coils has been chosen, with an air gap of $\frac{5}{64}$ in. The low start of the meter disk has been made feasible by its extremely light weight (12 grams complete with shaft). At full load the meter disk runs at only 30 r.p.m. The wear of the bearings of a meter is proportional to the product of weight and speed of the meter's armature. For this meter this product is 360, while most of the existing meters give products between 1,800 and 2,400. The base and the cap of the meter are of pressed steel. The nameplate and the glass windows are held in place without the use of removable screws, a detail which makes this meter safe against fraudulent attempts to insert in it foreign bodies such as wires.—*Revue Générale de l'Electricité*, Jan. 12, 1924.

Oscilloscope for Examining High-Speed Movements.—A. J. H. ELVERSON.—An opto-mechanical device has been designed to facilitate the examination of the behavior of high-speed movements under working conditions. This is effected by presenting in rapid succession accurate pictures of the movement at predetermined intervals of angular displacement in such a way that, owing to the persistence of vision, the eye of an observer sees a true representation of the movement at a speed which is a fraction of the true speed. The electrical circuit of the apparatus, means for lighting, contact breakers and arrangement for apparatus are discussed.—*Journal of Scientific Instruments* (*England*), January, 1924.

Effects of Time and Frequency on Insulation Test of Transformers.—V. M. MONTSINGER.—Permanently grounded transformers must receive their insulation test by inducing the necessary voltage across the windings. The A. I. E. E. Standards specify that the time of induced-voltage tests shall be the same as for high-potential tests. In certain cases where the transformers are of very large capacity the induced voltage must be made at a frequency several times higher than normal. Since the dielectric strength of most insulating materials decreases with an increase in the frequency, an investigation has been made to determine the proper and fair length of time to make the induced-voltage test when the fre-

quency is higher than normal. The main points brought out in the investigation are given.—*Journal of A. I. E. E.*, February, 1924.

Illumination

Working with the Architect on Difficult Lighting Problems.—A. D. CURTIS and J. L. STAIR.—The cost of the lighting of a building is not represented by the cost of the luminaires, but is measured by the satisfactory character of the illumination effects produced in the building. The necessity for early consultation between the architect and the lighting man in the planning of the lighting features of a building is emphasized as well as the responsibility of the lighting man in developing in himself an appreciation of architectural values so as to work most intelligently with his architectural colleague. Specific examples of difficult lighting problems are given to illustrate some of the advantages to be derived by considering the lighting as a component part of the structure.—*Transactions of the I. E. S.*, January, 1924.

Engine-House Wiring and Lighting on the Santa Fé.—An effective method of wiring roundhouses in which lead-coated wrought-iron pipe is used for conduit is described. When installing this conduit all threads and fittings were lead-coated by the wiremen to prevent any corrosive action of the gases. The layout of wiring and lighting unit is described in detail with suitable drawings.—*Railway Electrical Engineer*, January, 1924.

Motors and Control

Variable-Speed Drives for Calico Printing Machines.—Some of the problems that are encountered when cotton goods, particularly calico fabrics, are run through a printing machine are discussed. Efficient speed control, both for correctly setting the printed patterns and also for drying the fabric in a suitable manner after printing, is an essential feature governing the commercial efficiency of the printing plant. Recently many applications of individual electric motor drives have been introduced, and on alternating-current systems the desired speed changes have been obtained by the use of a slip-ring induction motor. This system has shown that electric drives for such machines are quite feasible. The article contains a description of a five-color machine capable of printing cloth 42 in. wide at any speed running from 60 yd. to 20 yd. per minute.—*Electrical Review* (*England*), Feb. 8, 1924.

Auxiliary Equipment for Blast and Ventilating Fans.—C. L. HUBBARD.—Supporting the fan and drive to meet various conditions, the prevention of vibration, air velocities, engine and turbine drives, direct and alternating-current motor drives and speed regulation with motor drive are the principal subjects discussed in this article. —*Power*, Feb. 6, 1924.

Pulsations in Power Due to Synchronous-Motor-Driven Compressors.—QUINTON GRAHAM.—The recent ruling of the Electric Power Club concerning the pulsations of power which result from the use of synchronous motors with reciprocating compressors or similar machinery has been the cause of a renewed interest in the effect of such pulsations. The causes and effects of pulsations and methods of combining loads to counteract this effect are discussed.—*Electric Journal*, February, 1924.

Synchronous Motors Applied to Mining.—G. B. ROSENBLATT.—The possibility of cutting power costs and improving operating conditions responsible for the increased use and application of synchronous motors in mining and milling is discussed. Typical installations of synchronous motors driving flotation blowers, exhaust fans, air compressors and pumps are described and illustrated.—*Engineering and Mining Journal-Press*, Feb. 23, 1924.

Electrophysics, Electrochemistry and Batteries

Friction Between Sliding Surfaces.—H. M. BARLOW.—It has often been demonstrated that when an electric current has passed across certain sliding contacts the friction undergoes a change. In most cases the flow of electricity across the junction is accompanied by an increase in the friction, but in a few instances a slipping action is produced. Both these effects have been applied to the operation of telephone and related devices, but only a tentative explanation has so far been given of many of the complicated phenomena with which they are associated. In this paper a number of experiments designed to explain these intricate processes are described, and in the light of these investigations an attempt has been made to build up a comprehensive theory of their action.—*Journal of the Institution of Electrical Engineers* (*England*), February, 1924.

Traction

Vibrations on Electric Locomotives. —I. DÖRY.—On electric locomotives with rod drive vibrations of dangerous magnitude are sometimes observed at a certain critical speed. The large mass of the rotating armature of the motor makes these vibrations much more prominent than is the case with the rod drive on steam engines. The paper mathematically investigates the cause of these periodic vibrations and seems to indicate that play in bearings is largely responsible for it. The fact that the vibrations occur under no load as well as at full load tends to support the author's conclusions. The use of properly placed springs in the gear mechanism is a means for avoiding vibrating and resonating phenomena.—*Elektrotechnik und Maschinenbau*, Jan. 27, 1924.

Ventilated Traction Motors.—E. HELDE.—According to the path which the stream of air takes through the motor, single, double and compound ventilated motor designs are known, of which the first mentioned is used only for very small motors. An arrangement of fan-shaped spider arms within the rotor, or fan blades placed between the laminations of the rotor, is much less effective than a ring-shaped fan mounted on the motor shaft next to the armature. Tests extending over several years and made on motors of various manufacture seem to indicate that a design in which the air current is split up in two parallel streams, one passing between the stator poles and the other through the rotor, gives the best results. Every ventilated motor will at times suck in moisture from the atmosphere. Assuming a well impregnated motor winding, this temporary introduction of humidity will do no harm and the motor will soon dry. Dust or sand which is carried into the motor is more harmful and may cause a rapid consumption of the motor brushes. The simple expedient of an air filter at the air intake remedies most dust troubles. Tabulations and curves are given showing comparisons between closed and ventilated traction motors.—*Revue Générale de l'Electricité*, Jan. 12, 1924.

Telegraphy, Telephony, Radio and Signals

Factors Affecting Telegraph Speed.—H. NYQUIST.—The following two fundamentally important factors in connection with the problem of transmitting the maximum amount of intelligence over a circuit receive principal attention in this article: (1) Signal shaping; i.e., giving signals the best wave shape before impressing them on the transmission medium. (2) Choice of codes so as to transmit the maximum amount of intelligence with a given number of signal elements. These factors are discussed with the idea of indicating the best methods, as well as to give an idea of what may be expected from these methods.—*Journal of A. I. E. E.*, February, 1924.

Relations Between Damping and Speed in Wireless Reception.—L. B. TURNER.—The first part of the article is devoted to an examination of the ordinary method of recorder working in wireless-telegraph receivers as affected by the damping of the receiver circuits. After a résumé of the significance of the decrement of an oscillatory system its bearing on the possible speed of recording Morse signals is investigated, and the relation between speed of signaling and the requisite transmitter power is then taken up. In the second part an improved method of reception, called "receiver curbing," is described and analyzed. An estimate is made of the improvement obtainable, and practical circuits are given for putting the method into effect.—*Journal of Institution of Electrical Engineers* (*England*), February, 1924.

Telephone Relays.—S. P. SHACKLETON and H. W. PURCELL.—Many kinds of relays are employed in the Bell Telephone System, varying from simple electromagnetic drops to the sequence switch, the thermionic vacuum tube and the panel selector. The author presents the relay developments leading up to and making possible the present communication system, which is outlined with particular reference to electromagnetic relays. A few typical circuit applications are given with a discussion of the requirements imposed upon relays that influence their design. Several types of relays are illustrated and their distinctive features described.—*Bell System Technical Journal*, January, 1924.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Busbars, Sectionalizing of

We operate the relay connecting the house turbine with the main unit by means of underspeed device on the house turbine. This opens the switch paralleling the two buses. Several tests have been made to see how satisfactorily this will work under different conditions, and in the most severe tests this type of protection has demonstrated its reliability.—*West Penn Power Company, Connellsville, Pa.*

Current Transformers, Load Testing of

Tests have been made on a light-weight split-core current transformer and the device has been found to be commercially accurate. Owing to a special secondary winding that would require special instruments there is some question as to the advisability of using it if the difference in the weight as compared with the same capacity transformer in use at present is not too great.—*Consumers Power Company, Jackson, Mich.*

Exciter, Duplex-Driven

Several tests have been made on our duplex exciter by opening the alternating-current motor switch. The turbine is of simple construction, not efficient in steam consumption, but is equipped with a hydraulic governor. When the interruption to the motor occurred, the steam turbine picked up the exciter load at once, without noticeable variation in voltage of the main unit. This duplex-exciter set is equipped with a relay worked by an overspeed device, which disconnects the generator from the direct-current source of power in case it tends to motorize.—*Duquesne Light Company, Pittsburgh, Pa.*

Pipe, Butt-Weld, Scale Removed from

It has long been appreciated that butt-weld pipe free from welding scale would be of considerable benefit to pipe consumers in many fields of service. After extensive research and experiments a mechanical process has been evolved whereby the scale is removed from both the exterior and the interior of butt-weld pipe in sizes from ⅜ in. to 3 in.—*National Tube Company, Pittsburgh, Pa.*

Oscillograph, Cathode-Ray, High-Frequency

A Braun-tube oscillograph has been developed suitable for recording currents of frequencies running into hundreds of thousands per second. The device is described in detail in *Recherches et Inventions* of December 15, 1923.—*M. A. Dufour, Sorbonne, Paris, France.*

The United States Department of Agriculture has undertaken to study and classify all of the vast amount of data it has on file relative to this subject, in accordance with a request made by the joint committee on the relation of electricity to agriculture. The department has drawn up an outline of procedure which when completed should go far toward answering many of the fundamental questions.

Reactor, Saturated-Core Type

A so-called saturated-core reactor having an iron core normally saturated by a direct-current winding has been developed with such a characteristic that the reactance under short circuit is much greater than that under normal load. An application of these reactors is being made to tie together the auxiliary service buses, one of which is fed by the house turbine and the other by the house transformer. This permits an interchange of power for heat balance under normal conditions and limits the flow of current from one bus to the other should a short circuit occur.—*General Electric Company, Schenectady, N. Y.*

Sound, Vowel, Photo-Mechanical Analysis of

The original oscillogram of the wave form was first transformed into a black profile record and joined to form an endless belt, which was passed at definite speed repeatedly in front of a transverse slit. The fluctuations thus produced in a transmitted beam of light actuated a solenium cell which was connected across a tuned circuit to an amplifier and measuring instruments. By suitable adjustment of the belt speed and of the tuned circuit any frequency component of the original record could be measured.—*C. F. Sacia, Western Electric Company, New York City.*

Triode Tubes with Alkali Vapor

Three-electrode tubes containing potassium-sodium alloy vapor were found to be very sensitive detectors in radio receiving circuits at low plate voltages. This sensitivity is due to the low ionizing potentials of these vapors, and probably also to other characteristics of such vapors, as photo-sensitivity, contact potential, etc. These tubes are much less critical than are gas-content detectors; they are steady in their action, needing no frequent adjustments of filament current or plate voltages.—*H. A. Brown and C. T. Knipp, University of Illinois, Urbana.*

In Progress or Purposed.

Agriculture, Electricity in

In co-operation with the Alabama Power Company, we are conducting an investigation on the above subject. One man is now devoting his entire time to electrical research at the college and another is looking after the field work. The plan as outlined contemplates research projects at the college and the establishing of an experimental electrified farm community in each of the leading agricultural sections of the state.—*Alabama Polytechnic Institute, Auburn, Ala.*

Pumps, Boiler-Feed, Regulator for

We have made a number of tests of steam-turbine-driven boiler-feed pumps using excess-pressure-type and constant-pressure-type regulators. These regulators operate very satisfactorily from normal capacity down to one-third capacity, but there is a tendency to give uncertain results where the capacity of the pump is less than one-third of normal output. In other words, the regulator is not positive under these conditions and causes a surging action in the pump. We are continuing our experiments in co-operation with the manufacturers of regulators, and we expect to overcome some of the above difficulties.—*Worthington Pump & Machinery Corporation, New York City.*

Steel, Correlation Between Magnetic and Other Physical Properties of

A method of resolving the reluctivity line into two components, which apparently represent the magnetic properties of the portions of steel that are in tension and compression, has been worked out. If further work establishes the validity of this method, we have a means at our disposal for evaluating the effects of mechanical stress. The experiment also indicates that the difficulty of establishing any universal laws of correspondence between the magnetic and other physical properties of steel is probably due to the effect of initial stresses.—*R. L. Sanford, Bureau of Standards, Washington, D. C.*

Wire-Rope Hoisting, Non-Destructive Testing of

An investigation is under way on the possibility of developing a non-destructive method for the testing of wire hoisting rope in place and under service conditions. Methods involving magnetic testing are receiving first consideration, and in order to ascertain whether or not they may reasonably be expected to work the magnetic properties of the material of the rope are being studied. The various influences which cause deterioration are: (1) Stress; (2) wear; (3) fatigue; (4) corrosion; (5) overstrain. The effect of each is being determined separately.—*R. L. Sanford, Bureau of Standards, Washington, D. C.*

Suggestions for Research

Coils, Cylindrical, Position of Zero Mutual Induction

In radio receiving sets with multiple amplification three or more identical inductance coils are sometimes mounted on the same face plate, with the axes parallel to one another. By making the angle between the line connecting the centers of the coils and the axes different from 90 deg. a position can be empirically found in which the mutual inductance between the coils is reduced almost to zero. It is desired to deduce theoretical formulas from which the best distance between the coils and the angle of tilt corresponding to zero mutual induction can be determined by computation for coils of given size.

Heat Economy in Power Stations

A number of plants have been recently installing closed systems of air circulation for generator cooling. The water system required for cooling transformer oil and lubricating oil may in such cases be extended to cool the circulating air. The total amount of heat so reclaimed is not inconsiderable and should be recovered in boiler-feed water or in the air used for fuel combustion.

Insulators, Porcelain

(1) Temperature cycle tests in which at the same time the cement is subjected to alternate humid and dry conditions, the moisture conditions being controlled in such a manner as to give maximum cement growth (provided appreciable growth can be obtained in a reasonably short period of time). (2) Vibration tests to determine under what conditions vibration becomes destructive to the porcelain body of an insulator. (3) Determination of the combined electrical and mechanical stress characteristics of porcelain. (This latter question is becoming of more and more importance with the increase in voltage and physical dimensions of our large transmission and distribution lines.) (4) Microscopic studies comparing the porcelain body of units which withstand test and those which fail under test.—*Overhead Systems Committee of the N. E. L. A.*

Polyphase Line Current, Inverse Phase Sequence

Three unbalanced line currents without neutral return may be resolved into two sets of balanced currents of phase sequence 1, 2, 3, and 1, 3, 2, respectively. An unbalanced load consisting of stationary impedances usually causes currents of inverse sequence 1, 3, 2 (in addition to positive-sequence currents), while a synchronous or induction machine readily absorbs them when the voltages are even slightly unbalanced. It is desired to investigate in the most general terms a combination of two such loads, together with a line and a generator, with a view to finding the best arrangement for absorbing inverse-phase-sequence currents. (See Fortescue, *A.I.E.E. Journal*, 1923, Vol. 42, page 205.)

Welding, Butt and Spot, Smoothing Fluctuations of Power Demand for

The recognized advantages of spot welding and butt welding have led to their wide adoption in mass production. This has resulted in a considerable increase in the instantaneous kva. demand of individual spot welders, so as to use them on larger pieces or to make a joint in shorter time. While it is hardly feasible to smooth down the power demand of such machines entirely, yet it would be of great advantage to other customers on the same source of power supply if the fluctuations could be somewhat reduced and the demand extended over a longer period of time by means of energy storage.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Southern California Edison and Boulder

Vice-President Ballard States Company's Position to Congressional Committee—Willing to Spend from Thirty to Forty Million Dollars Annually on Project

A CHAPTER was added on Wednesday of this week to the record of the hearings on the Swing-Johnson bill for government construction of Boulder Dam, in the Colorado River, which promises to furnish the most important single obstacle which has yet been placed in the path of that legislation. The chapter was contributed in a statement by R. H. Ballard, the vice-president and general manager of the Southern California Edison Company, which has large filings for the development of electric power on the Colorado. Mr. Ballard made it clear that his company is not opposing the development of the river by the federal government, but it does object to legislation which would give great special privileges to an association of municipalities whose aim would be to force the private power companies out of business.

"The Southern California Edison Company is not opposed to an appropriation by the government for the control of the Colorado River, nor to my knowledge is any other power company opposing such a measure," said Mr. Ballard. "The Imperial Valley of California is entitled to protection from the menace of floods caused by the erratic flow of this international stream, and all of the potential electric capacity of the river should be developed. The entire development will be needed in the course of time to serve the requirements of the seven Southwest states in the Colorado basin. If the government will start this development by providing funds for the construction of the first dam, we are prepared to make the electrical installations and generally distribute power throughout the whole territory to municipalities, industries, farms and domestic consumers under jurisdiction of the United States government and regulation by the state regulating commissions. If for any reason it is found inexpedient for the government to make this appropriation, we are prepared to do the whole job. Development by the company would be under the terms of the federal water-power act providing for a limited tenure of fifty years, with right of the government at the end of the period to take over the property at cost as determined by the Federal Power Commission under the cost-accounting system which the commission has established.

"I have today filed with the arid lands committee a statement in writing signed by our president, John B. Miller, pledging an expenditure of from thirty to forty million dollars a year for this work. Mr. Miller points out that the financing would be accomplished through the sale of bonds to investors throughout the country and the sale of the company's capital stock direct to the people in the whole territory served and who would be benefited by the development.

"To avoid waste, duplication and loss of interest all expenditures made by either the government or ourselves should be based upon a co-ordinated plan for the full development of the river as a whole as finally determined by the government engineers from all departments having jurisdiction. Such a co-ordinated plan should be carefully worked out with respect to market conditions and economic development to insure the eventual reimbursement of the cost of the dam from electric power revenues. The Swing-Johnson bill now under consideration, calling for an appropriation of seventy million dollars, does not do this.

Los Angeles Water Supply

"It is true that Los Angeles City will need an additional domestic water supply ten years or so from now if its present rate of growth continues, and the enormous expenditure of bringing water to Los Angeles from the Colorado River may eventually be justified. There are, however, other sources of water to be obtained by Los Angeles if it will complete its aqueduct system in the Owens River Valley, and there are additional water resources also close at home which will provide enough water for the requirements of ten million people. The present population of Los Angeles is one million.

"The company is willing that any license or permit granted by the United States government or by the states affected shall be subject and subordinate to the Colorado River compact signed at Santa Fé, N. M., last year, respecting the relative rights of the states in the Colorado basin to the waters of the river."

Mr. Ballard then gave figures on the capitalization, output and ownership of the Southern California Edison Company and its pre-eminent status as a community enterprise, concluding:

"I am convinced that the company can produce and distribute power from the Colorado at a lower cost to consumers than in the case of any other possible agency. This lower cost would include the payment of large sums in taxes to the states and the federal government. Under a combined government and municipal development plan all of the physical property would escape taxation and all of the securities would be tax-exempt."

Fight a Threatened Shortage in Southern California

Threatened power shortage in California caused by an extremely dry season has reached a stage where the California Railroad Commission has called a series of meetings of power-company engineers and officials to study the situation and determine the best means of allocating the available power in a manner to meet the most urgent demands. In the latest conference of this kind, which was held in Los Angeles on March 10, it was made apparent that the situation was most acute in southern California, but not alarming in any part of the state, as recent rains have brought alleviation. Energetic steps to increase the power supply and decrease the demands will assist in forestalling a serious shortage.

Among the steps that have been taken are the placing in operation of new small generating units, the placing in operation of more or less obsolete generating plants, further interconnection between generating systems and the placing in operation of small industrial plants. The power companies have asked their consumers to reduce their power demands as far as practicable in the south.

The San Joaquin Light & Power Corporation has entered into a fifteen-year contract with the Turlock Irrigation District for the purchase of 6,500 kw. of electrical energy from the latter's Don Pedro hydraulic plant in central California. The San Joaquin company will start construction immediately of a 16-mile, 66,000-volt line to bridge the gap between the two systems from Turlock to Livingston, Cal. The line will be completed by April 1, and it is expected that this interconnection will help to relieve the threatened power shortage in central and southern California.

New England Utilities Overcome Storm Conditions

Central-station companies in New England came through the heavy storm this week remarkably well, considering its severity. Fallen wires caused temporary service interruption at Brockton, Mass., and Rhode Island was hit hard as to telephone service, about 200 poles being down Wednesday. The Boston Edison company lost less than a dozen poles out of 110,000 in service. Suburban trolley service in central Massachusetts was severely handicapped, and telegraph and railway signal lines suffered considerably.

Majority of Eighty-five for McKenzie Bill

Farmers' Clamor for Cheap Fertilizer Leads House to Vote Muscle Shoals to Ford—Senate Committee Will Hold Comprehensive Hearings

ALTHOUGH it had been conceded by those opposed to Henry Ford's offer for Muscle Shoals that the House of Representatives would accept it, there was very general surprise when the McKenzie bill was passed with so large a margin as eighty-five votes. On the final passage of the bill, which did not take place until Monday of this week, the yeas were 227, the nays 142, with one member voting "present" and sixty-one members absent.

Another surprise for the opponents of the McKenzie bill was the decisive way in which the House voted down their amendments, no single one of which was attached to the bill. The Madden amendment making available $3,472,487.25 for the construction of an auxiliary steam plant to take the place of the Gorgas steam plant was the only one adopted. Prior to the voting it was thought almost certain that the bill would be amended so as to provide for loss of rights in case a period of two years should pass during which there should be failure to manufacture nitrogen at the rate of 40,000 tons annually. An amendment to that effect was lost by a vote of 176 to 197. It also had been thought that there would be a close vote on the proposal to recommit the bill with instructions to report it back to the House amended so as to bring it under the water-power act. Instead of being close, the vote was 144 to 224. An amendment specifying that the Alabama authorities should prescribe the rates for power sold within that state and giving the Federal Power Commission control over the rates to be charged in the transmission of interstate power had the support of only 76 votes.

ADVERSE COMMENTS

Following the vote, Representative Burton of Ohio compared the action of the House with the leasing of the naval oil reserves. He said Muscle Shoals would be more profitable to Mr. Ford than the naval oil reserves are likely to be to any man. Mr. Burton preferred the Hooker offer to that of the Southern Power Companies, as did also Representative Graham of Pennsylvania. Representative La Guardia of New York denounced the McKenzie bill and championed government operation.

Senator Norris, the chairman of the Senate committee on agriculture, made a comment to the effect that the House has voted the equivalent of more than $200,000,000 to the nation's richest man. Owing to the fact that Senator Norris is known to be violently opposed to the Ford proposal, there had been suggestion that the bill might be referred to the committee on military affairs, as was done in the House. The reference, however, was to the committee on agriculture, which conducted hearings on Muscle Shoals bills in the last session of Congress. A majority of this committee was opposed to the Ford offer last session, and only two new members have been added—Senator Magnus Johnson of Minnesota, who is understood to be against the Ford bill, and Senator Ralston of Indiana, who has made no announcement of his views.

It is very evident that long delay faces the Ford bill in the Senate. Senator Norris already has announced that the hearings will not be confined to the Ford offer. Ample opportunity will be given, he declares, for hearing the advocates of the other offers and those who advocate government operation.

It was apparent from the debate in the House that much of the pro-Ford sentiment had its source in the hostility among farmers to the fertilizer companies. It was further charged that the large financial interests of the country are against the Ford offer because of the effect Ford operations at Muscle Shoals are likely to have on the securities of hydro-electric, chemical and aluminum companies. In closing the arguments for the McKenzie bill Representative Madden, the Republican leader, told the House that Mr. Ford, in his opinion, has chosen to make Muscle Shoals his monument. "He wants," Mr. Madden said, "the monument to be a utilization of his fortune, made out of the farmers of the nation, in placing in the farmer's hands the opportunity to secure fertilizer cheaper than he could buy it under any other conditions." Mr. Madden contended that the states could regulate the charges for electrical energy from Muscle Shoals.

Transmission Right-of-Way to Nashville for Ford?

Nashville (Tenn.) newspapers say that, in anticipation of Muscle Shoals going to Henry Ford, agents are already busy obtaining grants of right-of-way for transmission lines from Florence, Ala., to Nashville, to convey electrical energy to the Tennessee city as well as to furnish power for an electric railway which, it is asserted, the Michigan capitalist will operate between the two places named.

Sweeping Public Ownership Bill in Congress

Among the aims of a bill introduced this week in the United States Senate by Senator Norris of Nebraska and in the lower house by Representative Keller of Minnesota, on behalf of the Public Ownership League of America, is the linking up of Muscle Shoals, Boulder Canyon and the Colorado River in a great public superpower system, functioning under government control, to produce and sell electricity, fertilizer and nitrates for explosives on a cost basis. This bill, which, its promoters assert, is first of all a measure to assure a "positive and aggressive conservation policy on the part of the federal government," provides for "the creation of a federal Public Service Commission to co-operate with the various states, municipalities, districts and other political subdivisions in the development of a superpower system to be publicly owned and operated." Of this the existing municipal plants are to form the nucleus. The bill purports to safeguard the rights of the states, eliminate politics and provide for "service at cost and cost cut in two." A bond issue of $500,000,000 is provided as a revolving fund with which to carry on the initial work and development.

Chicago "Tribune" on Ford

Denounces Bill Giving Muscle Shoals to Him as a Worse Scandal than Teapot Dome

THE Chicago *Daily Tribune* of March 12, in addition to publishing a front-page cartoon on the subject, devoted its sole editorial to the "Rape of Muscle Shoals." It saw in Muscle Shoals a scandal greater than Teapot Dome and said:

"If the name of Morgan were attached to this intrigue, the passage of the bill would ruin every man associated with it. The magic of Ford's name will not prevent it now, although it may delay it. Neither party can carry this scandal. The awakening may come slowly, but it will come."

The *Tribune* contrasted Ford's offer with that of the associated Southern power companies, showing the inferiority of the former to the latter by many millions of dollars on the question of payment alone, and said: "Government is surrendering a superpower station for many generations of American citizens at the dawn of the superpower age."

"It should be noted as interesting," said the *Tribune*, "that Representative McKenzie of Illinois, who introduced the Ford bill, will retire from Congress. The Muscle Shoals bill is to be probably his last important contribution to his country. It ought to be. This man of untold wealth, the greatest politician of his day, is successfully manipulating an intrigue which has involved the presidency of the United States, the nominations of both parties and the Congress of the United States, in which party lines were lost and in which even radicals have held their tongue. The Congress which is surrendering national wealth the value of which no one can comprehend is rocking with the scandal of naval oil leases and the intrigues of oil men with Cabinet officers. In Teapot Dome and Elk Hills it is of record that the government was getting a return. The leases may be detrimental to public interest and national defense and they may have been corruptly made, but, whatever they are, they are dwarfed by the sell-out of this water power. For a scandal which will stand in proportions equal to those of Muscle Shoals we must pass over oil as insignificant."

The editorial, which is two columns in length, claims that Ford has made himself so feared that when he reaches out for national wealth there is a conspiracy of silence which envelops even customary bold champions of popular

rights. "He has created by his brilliance of advertising, his genius for publicity and organization, the great fiction of Ford the superman, the Aristides, the friend of the average man, the modest possessor of untold money used for the benefit of people who without him might be unfortunate."

The *Tribune* concludes with these words: "There will be an exposure of the phenomenal reality obscured in this fantastic fiction, and then God help the men who submitted to the intrigue against national resources and who threw their country to Moloch!"

Albany Deadlock Unbroken

Advocates of Rival Water-Power Measures in New York Legislature Dispute at Hearing

OPPOSITION from unexpected quarters manifested itself at the legislative hearing at Albany on Wednesday upon the rival water-power measures now before the Legislature. As already explained in the ELECTRICAL WORLD, both these bills provide for a survey of the state's water powers and for setting up a Water Power Authority to control them, but the Democratic bill, fathered by Governor Smith, contains a declaration of the purpose of the State to retain for its own emolument all unappropriated sites which the Republican bill, sponsored by Speaker Machold, omits. The Democratic measure also cedes all right and title from the state to the Power Authority and provides that bonds shall be sold only on security of revenues to be derived from the project. The Republican measure pledges the properties of the Power Authority as well as the revenues toward the payment of the bonds.

The unexpected opposition arose when Francis E. Cullen, a prominent Democrat, appeared for the city of Oswego, which at the time of the construction of the Barge Canal suffered a loss in water-power rights to the extent of $4,000,000. Mr. Cullen maintained that the administration bill would preclude the completion of the contractual obligations of the state in this matter. Charles E. Norris of Carthage, also a Democrat of prominence, objected to the measure as preventing river regulatory districts from acquiring further title to state-owned lands, pointing out that the development of water power is incidental to the creation of storage reservoirs. Fear of interference with city water supply was also expressed.

Morris Cohn, Jr., representing the Niagara Falls Power Company, made a comparison between the cost of the electricity produced by that company and that produced by the Ontario Hydro-Electric Power Commission, claiming that during 1922 the city of Toronto, which has a distribution system of its own, purchased from the Hydro-Electric Commission 300,412,000 kw.-hr. at the city limits at 6.1724 mills per kilowatt-hour, or twice the amount paid by the Buffalo General Electric Company to the Niagara Falls Power Company.

Other opponents of the Rabenold, or administration, bill were N. F. Towner of Albany, representing the Cohoes Power & Light Company and the Utica Gas & Electric Company; Fred D. Corey, Niagara, Lockport & Ontario Power Company; Henry Killeen, Lower Niagara River Power & Water Supply Company, and J. Boardman Scovell, American Superpower Corporation, which has applications pending in Albany and Washington. Of the two bills, the McGinnies, or Republican, measure, was favored by the private power companies as the least objectionable.

As already stated, neither bill can pass the Legislature. The Democratic measure will pass the Senate and the Republican measure the Assembly, and that will in all human probability end the matter for this session.

HOME-RULE HEARING

On the same day there was a joint hearing before the Senate and Assembly committees on public service on the home rule transportation and public utilities bills fathered by Mayor Hylan of New York. The Mayor made a belligerent appeal for their passage, which was strongly opposed by the New York Chamber of Commerce, Citizens' Union and street railway companies.

Hoover Against Air Monopoly —Thayer Doesn't Want It

Regarding the radio broadcasting situation Secretary of Commerce Hoover said this week: "While it is impossible for me to express any opinion on particular issues that are before the courts or the Federal Trade Commission, I can state emphatically that it would be most unfortunate for the people of this country, to whom broadcasting has become an important incident of life, if its control should come into the hands of any single corporation, individual or combination.

"The effect would be identical whether this control arose under a patent monopoly or under any form of combination, and from the standpoint of the people's interest the question of whether or not the broadcasting is for profit is immaterial. I believe it is safe to say, irrespective of claims under patent rights on apparatus, that broadcasting will not cease and neither will our public policy allow it to become monopolized."

President H. B. Thayer of the American Telephone & Telegraph Company, while declaring that a multitude of broadcasting stations would destroy the value of the entertainment to those receiving it, and also that it was necessary for holders of infringed patents to prosecute the infringers or else in effect dedicate valuable property to the public use, said: "Regulations for the entertainment of the public by wireless are under consideration by Congress, and when that body acts we shall gladly accept its regulations as relieving us from any obligation to protect the public. We have no desire for a monopoly of the air."

The New York City administration has obtained an appropriation of $50,000 for a broadcasting plant and means to enter the lists with a municipal station.

Oklahoma Men Gather

Many Papers of Electrical Interest Are Presented at the Annual Utilities Convention

A FULL and well-balanced program marked the sixth annual convention of the Oklahoma Utilities Association, which was held March 11, 12 and 13 at Oklahoma City, with an attendance of six hundred. Public relations, financing and general management problems, commercial activities, billing and accounting and meter subjects all came in for their share of attention, and about twenty-five papers of special interest to electric light and power men were presented. General or joint sessions were held every morning and afternoon. Short entertainment features were interspersed throughout the sessions, and exhibits were made by manufacturers. A reception and ball were held on Tuesday night and a banquet and entertainment on Wednesday. On the latter occasion Governor M. E. Trapp was the guest of honor.

The viewpoints of commission representatives were given in talks on the proper functions of commissions and difficulties that confront them. Street lighting and its effect on central stations was discussed, as was the merchandising of electrical appliances. Billing and accounting were touched on in several papers, one discussing billing on small properties and equipment for simplifying the work. Résumés of progress and problems in utility accounting, in store-room accounting and in uniform accounting were made, and other problems discussed were theft of electricity and protective devices, placing and relocating meters, transformer and meter records and the importance of station output data.

John F. Gilchrist, vice-president of the Commonwealth Edison Company, Chicago, spoke on "Superpower." He said that the chief difficulty in the way of establishing a network of high-power lines throughout the country would lie in the jealousies of private-plant owners. "Superpower is not new," he said. "We have made use of the idea in the electric field in a small way for years. It consists in a simple form of combining the output of many small plants and regulating the load to meet the varying requirements throughout the system." Erection of power plants at strategic points throughout the country and subordinating them to one control is the only way that a superpower idea can be worked out, Mr. Gilchrist said.

Ben Hennessy, Hitchcock, Okla., touched on a plan for straightening the North Canadian River, saying that a dam could be erected which would provide enough power to supply the whole western half of the state.

A. D. Cameron, Schenectady, N. Y., discussed highway illumination and its effect upon the central station, drawing a distinction between lighting and illumination in city streets as well as in rural highway operation.

Other notable contributions were by J. F. Owens of the Oklahoma Gas & Electric Company, who discussed "Customer Ownership," and W. S. Vivian, Middle West Utilities Company, who told of "Success Through Service."

Chicago Superpower System

Next Step Will Be a 132-Kv. Line from Calumet Station 16 Miles to East Gary

PLANS for the next step in the establishment of a "superpower" transmission system having the generating stations of greater Chicago as a nucleus and reaching out into the industrial districts of the surrounding territory were announced last week. The first step, which has been completed, involved a 27-mile, 132-kv. line from the Waukegan (Ill.) generating station of the Public Service Company of Northern Illinois to Evanston, on the northern border of Chicago. The step just announced will involve another 132-kv. line running easterly and northerly from the Calumet station of the Commonwealth Edison Company in South Chicago to East Gary, Ind. This line will serve the great industrial districts of Hammond, East Chicago and Indiana Harbor and will be backed by the generating resources of the greater Chicago district, totaling over 1,000,000 kw. Calumet generating station alone has a capacity of 187,500 kw. in six large turbo-generators ranging from 30,000 kw. to 37,500 kw. in rating. Back of this is all the generating capacity of the stations with which it is already tied. Besides tapping this great pool of power, the new transmission line will be connected with the 30,000-kw. East Chicago generating station of the Northern Indiana Gas & Electric Company through its distribution system and with the 48,500-kw. Blue Island station of the Public Service Company of Northern Illinois through the Calumet Gas & Electric Company's connections with this company.

The new line will be approximately 16 miles in length and will carry about 40,000 kw. in the beginning, but will be constructed to carry 110,000 kw. ultimately. It will be built by the Calumet Power Company, a newly organized corporation of which Samuel Insull is president. The line will be built on private-right-of-way, 150 ft. wide, to Aetna, at the northwestern corner of East Gary, where a 40,000-kw. substation will be erected. Steel towers ranging from 95 ft. to 115 ft. in height will be used. The total cost of the transmission line, substation and private right-of-way will be approximately $1,000,000.

It is expected that this improvement will do much to build up the industrial district of northwestern Indiana by making available an unlimited power reserve and by assuring reliability of service not possible with isolated generating plants.

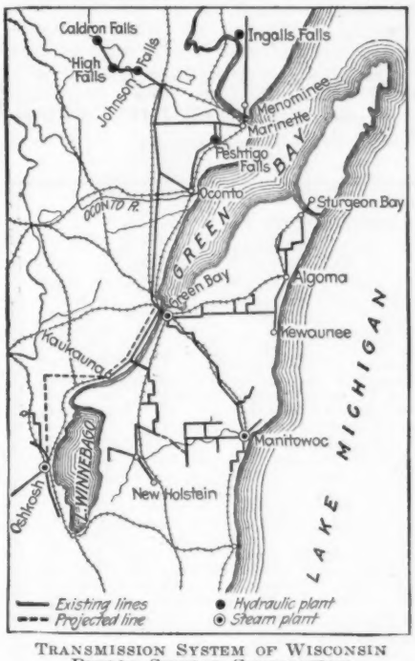
"Forbes" Offers More Prizes for Public Utility Essays

Forbes Magazine, which last year awarded prizes for the three best essays on customer ownership of public utility company stock, is now making a similar offer for papers on "How Sound Public Relations Between Public Utilities and Communities Can Be Best Developed and Maintained." The first prize will be $300, the second $200 and the third $100, and the contest is open to everybody. "What *Forbes* seeks," says the announcement, "is a plan which is practicable. Ideas should be based on present and past experience." Photographs, charts and supplementary data will be welcomed in the contest. The judges will be B. C. Forbes, the proprietor of the magazine, and two representatives of the National Light Association to be announced later. Right to publish any of the articles submitted is reserved. The one winning first prize will appear in the May 24 issue of the magazine. The contest closes on May 1, and manuscripts should be addressed to contest editor, *Forbes Magazine*, 120 Fifth Avenue, New York.

Oshkosh-Green Bay Line

Wisconsin Public Service Corporation Will Interconnect Stations in Northeast Countries

OSHKOSH, Wis., stands to benefit largely by improvements to be undertaken by the Wisconsin Public Service Corporation, which has headquarters at Green Bay. The presdent of the company, Clement C. Smith, announces that a large turbo-generator will be added to the steam plant at Oshkosh, doubling its present capacity, at a cost of $200,000, and that, in addition, a high-voltage transmission line from Green Bay to Oshkosh, a distance of 58 miles, will be built at an expenditure of $365,000. By means of this line Oshkosh will be interconnected with five hydro-electric stations in the northeastern part of the state and with the steam stations at Green Bay and Manitowoc.



TRANSMISSION SYSTEM OF WISCONSIN PUBLIC SERVICE CORPORATION

When line to Oshkosh is in service ten counties in Wisconsin and one in Michigan will be served by interconnected system.

The new line will follow the company's right-of-way to Kaukauna, thence run west on a line about 2 miles north of Appleton and extending south on a line about 3 miles west of Appleton, Neenah and Menasha. Both the undertakings mentioned will be started immediately and will be completed before the end of the year. When the line is finished, Mr. Smith says, the company will possess a power district or reservoir from which all of the sixty-two communities now served by it will be able to draw unlimited amounts of electrical energy at much cheaper cost than if produced by individual electric plants. With the completion of the line the transmission system will extend for 356 miles, reaching Menominee, Mich., on the east and extending north to the hydro-electric stations at Peshtigo Falls, High Falls, Johnson Falls, Caldron Falls (now under construction) and Ingalls Falls. The company is now selling energy to the municipal plants at Two Rivers, Algoma, Kewaunee, Sturgeon Bay and New Holstein.

Milwaukee and Appleton to Be Interconnected

Work on a junction between the lines of the Wisconsin Traction, Light, Heat & Power Company—which supplies Appleton, Wis., and the neighboring territory— and those of the Milwaukee Electric Railway & Light Company at Plymouth is to be begun as soon as preliminary plans are ready and weather conditions permit. The tie-in will be effected by a high-tension line between Hilbert, which the Appleton system now reaches, and Plymouth, a distance of 60 miles. Hilbert is 20 miles from Appleton, and Plymouth 100 miles from Milwaukee, so that the completed interconnection will be 180 miles in length. When the line is ready Appleton will be able to draw not only on the steam plants at Milwaukee, but on the Wisconsin River Power Company's hydro-electric plants at Prairie du Sac and Kilbourne, with which the Milwaukee system is connected.

Insull Interests May Buy Brewer Plants in North Indiana

The Samuel Insull interests, which already control the Interstate Public Service Company, the Northern Indiana Gas & Electric Company and other utility properties of northern Indiana, are soon to acquire four Joseph H. Brewer utility properties in that part of the state, according to reports among utility men of Indianapolis. Those properties are the Valparaiso Lighting Company, now controlled by the Central Indiana Power Company; the Lagrange County Light & Power Company and the Elkhart Gas & Fuel Company, controlled by the American Public Utilities Company, and the Plymouth Electric Light & Power Company, interest in which was acquired not long ago by the Central Indiana Power Company. The American Public Utilities Company is the top holding company of the Brewer interests. It owns the stock of the Central Indiana Power Company, which is a holding company for most of the Brewer Indiana properties. It is understood that the negotiations will soon result in the filing of a petition with the Indian Public Service Commission.

Institute Program for Birmingham Ready

Spring Convention of A. I. E. E. in Alabama's Chief Commercial City Will Take Up Water Power, Transmission and Mining and Metallurgical Applications

HEARTY co-operation on the part of electrical engineers throughout the Southern States insures a highly successful spring convention of the American Institute of Electrical Engineers at Birmingham from April 7 to April 11. Not only water power, transmission and the allied topics that suggest themselves as peculiarly fitting for a Southern meeting, but also mining and metallurgical applications and machine developments, will be discussed in the well-rounded program printed here. Hydraulic installation, oil circuit breakers, lightning arresters and electric furnaces will be among the equipment concerning which developments and practices in all parts of the country will be reported and put through the clearing house of debate.

Delegates to the convention will have an easy opportunity to visit the projects at Muscle Shoals and in the contiguous territory over which so much acrimonious political controversy has been waged, as well as to inspect the great interconnected Southeastern system covering Tennessee, Alabama, Georgia and the Carolinas and to visit the iron and coal mines, the steel and textile mills and the allied industrial activities of northern Alabama. The social and entertainment features of the gathering will include the customary features of automobile trips, golf, teas, dancing and so forth, and in addition it is planned to hold an old-fashioned Southern barbecue on the top of Shades Mountain, 7 miles from Birmingham, on Wednesday evening, April 9. W. E. Mitchell is the chairman of the committee in charge of the convention.

Program of Birmingham Convention, A. I. E. E.

MONDAY, APRIL 7

Morning.—Technical committee meetings and registration.

Afternoon.—"Hydro-Electric Practices and Equipment in the South," O. G. Thurlow and J. A. Sirnit, Alabama Power Company; "Hydro-Electric Practices and Equipment on the Pacific Coast," S. Barfoed, consulting engineer; "Developments in Hydro-Electric Equipment," W. M. White, Allis-Chalmers Company; "Acceptance Tests on Hydro-Electric Stations," F. H. Rogers, William H. Cramp & Sons.

Evening.—Informal reception and dance at Birmingham Country Club.

TUESDAY, APRIL 8

Morning.—"Lightning-Arrester Tests at 22 Kv. and 4 Kv.," W. F. Young, Duquesne Light Company; "Lightning-Arrester Experiences on the Coast," E. R. Stauffacher, Southern California Edison Company; "Lightning-Arrester Design and Operation," C. E. Bennett, Georgia Railway & Power Company; "Economics of Lightning Arresters," A. L. Atherton, Westinghouse Electric & Manufacturing Company; "Operating Experience with Relaying on the Duquesne System," H. P. Sleeper, Duquesne Light Company.

Afternoon.—"Southern Power Developments," Thomas W. Martin, president Alabama Power Company; "Financial Aspects of Hydro-Electric Developments," H. M. Addinsell, Harris, Forbes & Company; "New Type of High-Tension Interconnecting Network," Percy H. Thomas, consulting engineer; "Carrier Telephony on Power Lines," N. H. Slaughter and W. V. Wolfe, Western Electric Company.

Evening.—"National Water-Power Development," O. C. Merrill, executive secretary Federal Power Commission; "Best Ways of Using Water Power for the Benefit of the Public," P. M. Downing, vice-president Pacific Gas & Electric Company; "Public Relations in Water-Power Developments," Preston Arkwright, president Georgia Railway & Power Company.

WEDNESDAY, APRIL 9

Morning.—"High-Tension Oil-Circuit-Breaker Tests," H. J. Sholtz, Alabama Power Company; "Alabama Power Company Breaker Tests," R. W. McNeill, Westinghouse Electric & Manufacturing Company; "Oil-Breaker Tests," A. J. D. Hilliard, General Electric Company; "Oil Breakers from an Operator's Viewpoint," J. V. Jenks, West Penn Power Company.

Afternoon.—"New Synchronous Induction Motor," Val A. Fynn, consulting engineer; "65,000-Kva. Generators at Niagara Falls," W. J. Foster and A. E. Glass, General Electric Company; "Harmonics Due to Slot Openings," C. A. M. Weber, Westinghouse Electric & Manufacturing Company, and F. W. Lee, Johns Hopkins University; "22,000-Kva. Transformers at Niagara Falls," F. F. Brand, General Electric Company.

Evening.—Southern barbecue on Shades Mountain.

THURSDAY, APRIL 10

Special train to Mitchell Dam and Lock 12; leaves 7 a.m., returns p.m.

Morning.—"Electrical Safety in Coal Mines," L. C. Ilsley, United States Bureau of Mines; "Automatic Substations for Mines," C. E. Von Sothen, General Electric Company; "Tests on Mine Hoist Control," F. L. Stone and F. R. Grant, General Electric Company; "Automatic Substations for Industrial Plants," Chester Lichtenberg, General Electric Company.

FRIDAY, APRIL 11

Morning.—"Maximum Demand Regulator for Electric Furnaces," E. T. Moore, Halcombe Steel Company; "Manufacture of Phosphoric Acid in Electric Furnaces," Theodore Swann and F. V. Andrea, Federal Phosphorus Company; "Effect of Impurities on Battery Electrolyte," G. W. Vinal and F. W. Altrup, United States Bureau of Standards

Afternoon.—Special arrangements will be made to visit Muscle Shoals and points of interest in the vicinity of Birmingham.

Initial Draft of Program for Edgewater Beach

For the annual or midsummer convention of the A. I. E. E., which it has been determined to hold at Edgewater Beach, near Chicago, in the week beginning June 23, there will be, according to the initial draft of the program, besides the usual reports from the technical committees, twenty-seven papers, distributed as follows: Automatic substations, five; high-voltage cables, four; metropolitan distribution, four; standardization, three; transmission and protection, four; reactors, four; miscellaneous, three.

New Radio Regulation Bill Before Congress

Radio regulation has again been put before Congress by the introduction of measures to provide for federal control. In the House of Representatives Wallace White of Maine, the author of the bill which was passed by the lower chamber last year but failed to get through the Senate, has brought in a new bill drafted after consultation with officials of the Department of Commerce and others concerned, including representatives of the radio industry. Its primary purpose, Mr. White explains, is to reduce interference to a minimum and to develop an orderly system of communication.

Proposing repeal of the radio control act of 1912, the bill would require all transmitting stations and operators in the United States to be licensed by the Commerce Department, would provide for the allocation of wave lengths and would authorize the President to close or take over stations in time of war or disaster. Mr. White's bill would not require licenses for receiving sets nor would it attempt to exercise control over them. This bill provides for an advisory committee of fifteen members to whom the Secretary of Commerce may refer for examination and report problems arising in radio and relating to the laws and treaties of the United States and regulations thereunder.

The Secretary of Commerce would be directed to refuse a license to any person who, in his judgment, was "unlawfully monopolizing or seeking to monopolize radio communication, either through control of the manufacture or sale of radio apparatus, through exclusive traffic arrangements or by other means." Secretary Hoover is advocating the enactment of this measure.

Powell Fights Cooper's Application for White River

A formal protest against granting an application for either a preliminary permit or a license to the Hugh L. Cooper Company for rights on the White River in Arkansas has been filed with the Federal Power Commission by Walker Powell. The protest is based on the contention that the Dixie Power Company, which held a permit for three years on this river, has equities which the Cooper company is not willing to recognize.

It is probable that the Federal Power Commission will take the position that the Dixie Power Company has no standing before it in so far as the White River is concerned. The assumption is that any property rights of the Dixie Power Company are amply protected by the state laws. In acting on any application covering this stream, be it from the Cooper company or from anyone else, the commission will be governed by the merits of the proposed project and the ability of the applicant to finance it, regardless of the relationship between the applicant and the Dixie Power Company.

It is understood that the Cooper company or any other is free to acquire the essential state rights.

Reports Uniformly Good

Power Companies Prosper from Coast to Coast—Excellent Record of Byllesby Subsidiaries

THE Washington Water Power Company of Spokane had for the year ended December 31, 1923, gross revenue of $5,406,821 and net income from operation of $2,957,840, as compared respectively with $4,993,794 and $2,703,509 in 1922. After deductions for retirement, interest and dividends, there remained a surplus of $41,920, as against $32,593 in 1922.

The Idaho Power Company reports a balance for the year 1923, after interest charges, etc., had been deducted, of $613,796, compared with $687,781 in the preceding year.

The San Joaquin Light & Power Corporation reports gross operating revenue for the twelve months ended December 31, 1923, at $6,898,353, as compared with $6,405,115 for 1922; operating expenses at $2,954,544, as compared with $2,791,899; net earnings from operation at $3,943,808, as compared with $3,613,215, and net surplus from operation at $1,451,310, as compared with $1,220,912. An increase of 3.57 per cent in sales of energy is reported.

The Hartford Electric Light Company reports net income for 1923 to have been $2,017,400, as compared with $1,836,700 for 1922. After deducting interest and dividends, the balance for replacement reserve and surplus was $675,800, as compared with $439,000.

The Cumberland County Power & Light Company of Portland, Me., showed for its power and light department in 1923 gross income of $2,030,317, net income of $992,721, and surplus after deductions of $591,798. These figures represent increases of 14.8 per cent, 11.5 per cent and 14.4 per cent over the previous year.

The Buffalo General Electric Company reports total revenues in 1923 at $8,818,623, expenses at $5,835,601, non-operating income at $151,598, interest and income deductions at $770,458, and net income remaining at $2,364,161. Statement of surplus account shows a balance of $4,251,195 as against $2,975,900 in the previous year.

The Standard Gas & Electric Company, the holding concern controlled by H. M. Byllesby and associates, reports that the combined net earnings of all its operated public utility companies for the twelve months ended January 31, 1924, increased $2,650,366, or 16.20 per cent, as compared with the previous twelve months. Net earnings of the individual companies exclusive of depreciation are reported as follows as compared with the previous twelve months:

	Twelve Months Ended Jan. 31 1924	1923
Coast Valleys Gas & Elec. Co	$296,779	$199,045
Fort Smith Light & Trac. Co.	339,271	319,792
Louisville Gas & Electric Co. and affiliated companies	3,268,623	2,693,491
Mobile Electric Co	313,633	288,035
Mountain States Power Co.	646,396	534,976
Northern States Power System*	8,378,443	7,502,849
Oklahoma Gas & Electric Co.	2,281,488	1,790,078
San Diego Cons. Gas & Electric Co.	1,547,886	1,272,212
Southern Colorado Power Co.	783,680	718,717
Western States Gas & Elec. Co.	1,064,059	945,415

*Includes Wisconsin-Minnesota Light & Power and four other companies.

The Interstate Public Service Company of Indianapolis reports for 1923 gross earnings of $6,405,343, operating expenses (including taxes) of $4,825,177, net earnings of $1,430,519, and balance carried to surplus, after deductions for interest and dividends, of $137,087. Including the income from additional properties acquired during the year, the net earnings show an increase of $466,698, or 48½ per cent.

The Northern Indiana Gas & Electric Company, Hammond, Ind., reports an increase in gross revenue for 1923 over 1922 of $1,135,687, or 17 per cent. The total operating revenue was $7,624,883, which left a net income of $1,354,429.05 after deducting operating expenses, taxes and interest. For the same period the energy consumption jumped 26.34 per cent. The number of electrical customers increased 14.77 per cent.

Briefer News

Diminutive Motor with Real Use.—Reproduced here is a photograph of the punchings for the stator and rotor of possibly the smallest 110-volt motor made, not in the nature of a toy but

for real business operation. The motor is to go in the handle of an electric hair clipper and the punchings were made by the electrical sheet department of the Mansfield (Ohio) Sheet & Tin Plate Company. William J. Wooldridge is the manager of this department.

Municipal Plants in United States.—According to a recently published article by Carl D. Thompson, secretary of the Public Ownership League of America, there are in operation in the United States a total of 2,313 municipally owned electric light and power plants. Despite the hundreds of such plants that admittedly have been discontinued, Mr. Thompson claims that municipal plants are on the increase.

Electric Club of Los Angeles Elects Officers. — These officers have been elected by the Electric Club of Los Angeles for the year beginning this month: President, A. S. Mordy, General Electric Company; first vice-president, F. E. Seaver, Los Angeles Gas & Electric Corporation; second vice-president, Ben G. Wright; third vice-president, L. E. Moselle; secretary-treasurer, S. W. Murray; sergeant-at-arms, L. R. Ardouin.

St. Louis Company Closes Big Industrial Contract. — The Union Electric Light & Power Company, St. Louis, has closed a contract with the Pittsburgh Plate Glass Company for power, involving energy consumption of more than 50,000,000 kw.-hr. a year. The company will extend its transmission line to Crystal City, Mo., where delivery of the power will be made.

New Turbine for El Paso Company.—Included in the construction program of the El Paso Electric Railway Company for the year 1924 is the installation of a 15,000-kw. steam turbine at a cost of a million dollars. In addition to this $96,000 will be spent on the overhead distribution system, $28,000 on a "white way" lighting system and $9,000 on the underground distribution system.

Extensive Water-Power Project in Texas.—Word comes from Austin, Tex., that New Orleans investors have acquired an option on all the water-power rights on the Guadalupe River in south central Texas, from Kendall County through to Gonzales County. These sites can, it is asserted, be made to produce from 75,000 hp. to 100,000 hp. by the construction of thirteen dams.

Bear River (Cal.) Development.—The Bear River Water & Power Company of Auburn, Cal., has filed an application with the Department of Public Works of the state for permission to appropriate 250 sec.-ft. and 100,000 acre-ft. of water from Bear River in Placer and Nevada Counties for power purposes. The company desires to erect three generating stations and develop 42,994 hp.

New Street-Lighting System Planned for Syracuse, N. Y.—The New York Public Service Commission has approved the consolidation of the Syracuse Lighting Company and the Onondaga Utilities Corporation into a new corporation, the Syracuse Lighting Company, Inc. The financing will provide for new construction and betterments in its electric and gas service, totaling $5,752,733. A new street-lighting system in Syracuse will be included.

New Hydro-Electric Plant at Dayton, Ill.—A contract has been signed by the Illinois Power & Light Corporation to purchase all the power generated by a new hydro-electric station to be built by Fred D. Breit on the Fox River at Dayton, Ill., 4 miles north of Ottawa. The agreement provides for completion of the dam by April 1, 1925. With the power station it will cost more than $500,000.

Missouri Power & Light Company Organized.—The name of the Missouri Utilities Company of Mexico, Mo., has been changed to the Missouri Power & Light Company, and the new company has taken over the electric and other properties at Jefferson City, the properties of the North Missouri Light & Power Company from Hannibal down the river and the properties of the North American Light & Power Com-

pany in Oklahoma and Ohio. Under the new organization the company will operate directly or through subsidiaries utilities in forty-nine cities of Missouri, Oklahoma and Ohio. New interconnecting lines are to be built.

Pineville (Ky.) Plant Soon to Start.—The Kentucky Utilities Company is soon to start operating its new Pineville plant, a 15,000-kw. turbo-generator having been shipped there by the General Electric Company, with another one under construction. The Pineville plant will have an ultimate capacity of about 200,000 kw.

No Duty on Electricity.—The Treasury Department has reaffirmed its position that electrical energy from Canada is not dutiable. The original decision to this effect was written June 25, 1890, and has controlled under the various tariff acts placed on the statute books since that date, but several collectors of customs recently had written the Treasury Department for instructions under the 1922 tariff act.

M. I. T. Broadcasts Program Over Half the World.—Speeches and music were broadcast by radio over an area of 1,500,000 square miles and heard in San Francisco and London when six stations picked up the program at a dinner of the Massachusetts Institute of Technology in New York City a few days since and relayed it in all directions. The test, one of the most comprehensive yet made, was noteworthy as bringing into use an invention perfected by Frank Conrad of the Westinghouse Electric & Manufacturing Company which eliminated the use of telephone wires for the transmission of the music and words and put the entire program entirely into the air.

Switzerland's New Alpine Hydro-Electric Plant.—The water-power plant being constructed in the Alps at an altitude of 6,233 ft., near Martigny, Canton of Valais, for the purpose of supplying electrical energy to the Swiss Federal Railways, will be finished in 1926. It goes forward slowly, for at this high altitude the cold and the snow permit only one hundred working days a year. A dam is being built across the Barberine Cascades, whose waters flow in the River Rhone, to form an artificial lake of 40,000,000 cu.m. The cost of the dam will be 20,000,000 Swiss francs (about $4,000,000), but with the electric installation the amount will run over 60,000,000 francs. A total of 60,000 hp. will be supplied.

Salmon-Packing Interests Oppose Priest Rapids Project.—The only protest so far received by the board of army engineers which, under Col. W. J. Barden of Seattle, is conducting a field investigation of the huge hundred-million-dollar power project at Priest Rapids on the Columbia River for which the Washington Irrigation & Development Company is seeking a license from the Federal Power Board comes from the salmon-packing interests of the lower river. They complain that the dam which the company proposes to build at a cost of $28,000,000 will prevent salmon from reaching their spawning grounds at the Columbia headwaters. Agents of the power company have been assembling affidavits to show that the salmon run in the upper Columbia has been decreasing and is now small compared with the run of early days.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See January 5 issue, page 72, for latest list.]

Association of Electragists, Eastern Division—McAlpin Hotel, New York, March 18.

Empire State Gas and Electric Association—Electric Meter Section, Hotel Statler, Buffalo, March 20-21. C. H. B. Chapin, Grand Central Terminal, New York.

Illinois State Electric Association—Hotel Sherman, Chicago, March 26-27. R. V. Prather, Springfield, Ill.

Southern Appalachian Water Power Conference — Chattanooga, Tenn., March 26. J. A. Switzer, Knoxville, Tenn.

Association of Iron and Steel Electrical Engineers — Fuel-saving conference, William Penn Hotel, Pittsburgh, April 2 and 3.

American Institute of Electrical Engineers—Spring convention, Birmingham, Ala., April 7-11. F. L. Hutchinson, 33 West 39th St., New York.

American Society of Civil Engineers—Atlanta, April 9-12.

Middle West Division, N. E. L. A.—Kansas City, Mo., April 9-12. H. M. Davis, Bankers' Life Bldg., Lincoln, Neb.

Missouri Association of Public Utilities—Kansas City, April 10-12. F. D. Beardslee, 315 North 12th St., St. Louis.

Wisconsin Utilities Association—Hotel Pfister, Milwaukee, April 17-18. John N. Cadby, 445 Washington Bldg., Madison.

Southwestern Division, N. E. L. A.—New Orleans, April 22-25. S. J. Ballinger, San Antonio, Tex.

Southwestern Public Service Association—New Orleans, April 22-25. E. N. Willis, Dallas, Tex.

American Electrochemical Society—Hotel Bellevue-Stratford, Philadelphia, April 24-26. C. G. Fink, Columbia University, New York.

American Physical Society—Washington, April 25-26.

Rocky Mountain Division, N. E. L. A.—Cheyenne, Wyo., May 5-6. O. A. Weller, 900 15th St., Denver.

Wyoming Utilities Association—Cheyenne, May 5-6. H. C. Chappell, Casper, Wyo.

Nebraska Section, N. E. L. A.—Omaha, May 8-9. H. M. Davis, Bankers' Life Bldg., Lincoln.

National Electric Light Association—Atlantic City, N. J., May 19-23. M. H. Aylesworth, 29 West 39th St., New York.

National Electrical Credit Association—Chicago, May 22-23. F. P. Vose, 1347 Marquette Bldg., Chicago.

Electric Power Club — Seaview Golf Club, Absecon, N. J., May 26-29. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Electrical Supply Jobbers' Association—Homestead Hotel, Hot Springs, Va., June 4-6. Franklin Overbagh, 411 South Clinton Street, Chicago.

Pacific Coast Electrical Association—Hotel Coronado, Coronado, Cal., June 17-20. S. H. Taylor, 527 Rialto Bldg., San Francisco.

American Institute of Electrical Engineers — Annual convention, Edgewater Beach (Chicago), June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

Associated Manufacturers of Electrical Supplies—Hotel Ambassador, Atlantic City, N. J., June 24-27.

State Engineers Will Confer on Interconnection.—A conference of state engineers will be called by Secretary of Commerce Hoover soon after April 1 to consider the basic data which have been collected in connection with the survey intended to show the possibilities of electrical interconnection. The data are a compilation of the individual records submitted by the state engineers, together with all of the federal government's information which bears on the subject.

Light Snowfall Threatens Electric Output in Nevada.—According to a report of the water observer at Lake Tahoe on the line between California and Nevada, the snow level there now is at the stage that would be normal during June. There is a shortage of about 90,000 acre-ft. of water in the lake at the present time. The Truckee River Power Company, Reno, Nev., operating in Nevada, has an agreement with the United States Reclamation Service whereby it is to receive 500 acre-ft. of Lake Tahoe water from March 1 to October 1. Unless storms set in soon, Reclamation Service officials are said to be doubtful whether it will be possible to live up to the agreement.

Rural Service in Kansas. — Rural service plays a part in the new steam power plant that is being built by the Illinois Power & Light Corporation at Tecumseh, Kan., to supply Topeka, Atchison and other communities with electric power. The steel-tower transmission line, 6 miles long, now under construction between the new Tecumseh plant and Topeka, will supply farms along its route with electricity. Another line, 50 miles in length, will be built from the new power station to Atchison, and there is a possibility, too, of this line serving farms with power. The ultimate capacity of the Tecumseh plant, as already announced, will be 60,000 kw. The first installation will be 15,000 kw. and, including the transmission line, will cost $2,750,000. It is expected to be completed by the end of the year.

New York State Gas & Electric Will Serve Two Hundred Communities.—Interests affiliated with the New York State Gas & Electric Corporation of Ithaca have acquired the properties of the Livingston Manor Electric Company and the Callicoon Independent Electric Company, thus completing the chain of utility properties for which the corporation has been negotiating in the southern tier of the state, as noted here last week (page 499). Included in the acquisitions, which bring the number of communities served by the corporation up to more than two hundred, is the right to operate the properties of the Tri-County Light & Power Company in Schoharie, Green and Ulster Counties. Negotiations are now pending to bring power generated in the Adirondacks into the new territory by the building of high-tension lines. All of the New York State Gas & Electric Corporation's properties are under the management of the J. G. White Management Corporation of New York City.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

H. E. Manville Elected President of Johns-Manville

H. E. Manville, formerly vice-president and secretary of Johns-Manville, Inc., was elected president of the company at a recent meeting of the board of directors, succeeding T. F. Manville, who was made chairman of both the board of directors and the executive committee. Mr. Manville relinquishes to A. C. Hoyt the duties of secretary. Mr. Hoyt in addition assumes the treasurership, formerly held by T. F. Manville. L. R. Hoff, who has been sales manager of the company at New York, was made vice-president and general manager. Among those elected to a vice-presidency in the organization was James William Perry, general manager of the electrical, automotive and public utilities departments. Mr. Perry has been identified with Johns-Manville since 1889 and has been a prominent figure among electrical manufacturers for many years. At the present time he is treasurer and a director of the Electrical Manufacturers' Council, a director of the Electrical Manufacturers' Club, a member of the National Electric Light Association, in which he served for five years as chairman of the exhibition committee; of the American Institute of Electrical Engineers and of the American Electric Railway Association.

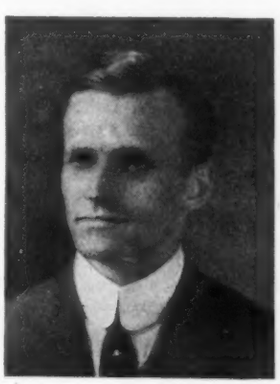
J. L. Harper and H. B. Taylor Head New Engineering Firm

John L. Harper, vice-president and chief engineer of the Niagara Falls Power Company, and H. Birchard Taylor, vice-president of the William Cramp & Sons Ship & Engine Building Company, have recently organized an engineering firm, Harper & Taylor, Inc., with offices in Philadelphia and Niagara Falls, N. Y. The new organization will engage in the general practice of engineering, especially the investigation of water powers and the design, construction, operation and management of hydro-electric power projects.

Mr. Taylor, who is president and general manager of the corporation, has long been identified with hydraulic engineering, and as a result of his experience in the design of hydraulic turbine and power-plant equipment he has been in close touch with the major water-power developments both in America and abroad. For a number of years he was hydraulic engineer of the I. P. Morris Company, now a department of the William Cramp & Sons Ship & Engine Building Company, and assistant to the president. In 1917 he was elected vice-president and a director of the Cramp company and took on the duties of finance and executive control. Mr. Taylor is president of the Pelton Water Wheel Company, a director of the Dominion Engineering Works and a vice-president of the American Society of Mechanical Engineers.

J. L. HARPER

Mr. Harper, vice-president and chief engineer of the new firm, has for many years been intimately associated with the development of water-power projects. He spent several years in the West with the Union Electric Company at Seattle and with the Twin City Rapid Transit and the St. Croix Power Companies at Minneapolis before entering the employ of the old Hydraulic Power & Manufacturing Company, Niagara Falls, in 1902. He was made its chief engineer two years later. Following the merger of the various power companies at Niagara Falls he assumed the duties of vice-president. The rest of the staff is composed of a group of engineers who have a background of wide experience in the hydro-electric field.



H. B. TAYLOR

L. A. Osborne, president of the Westinghouse International Company, returned to New York on Tuesday, March 11, on the Cunard liner *Aquitania*. Mr. Osborne has been on a trip around the world and while in Japan was decorated by the Emperor with the Third Order of the Rising Sun.

Theodore Dwight, who was associated with the Society for Electrical Development for many years, has become identified with the firm of Murray & Flood, engineers, New York. Mr. Dwight will engage in the analysis of problems of the electric utility field in which his past experience and activities have been centered.

W. B. Cline, president of the Los Angeles Gas & Electric Corporation, recently tendered his resignation as chief executive of that utility, and he has been succeeded by William Baurhyte, formerly vice-president and general manager of the company. Mr. Cline will continue to serve as chairman of the board of directors.

William Henry Patchell, British consulting engineer, has recently been elected to the presidency of the Institution of Mechanical Engineers of Great Britain. Mr. Patchell has served as vice-president of the technical society he has been elected to head and also of the Institution of Electrical Engineers. He is a frequent visitor to this country, where he has established highly cordial relations and connections as consulting engineer and as a fellow of the American Institute of Electrical Engineers.

Charles H. Forsgard, district superintendent of the western division of the Public Service Company of Colorado, with headquarters at Boulder, has been transferred to Durham, N. C., as general manager of the Durham Public Service Company. Both these properties are controlled by the Cities Service Company, New York. Mr. Forsgard has been associated with the Doherty properties in Colorado for a number of years and previously was identified with electrical utilities in Texas.

L. A. Safford, manager of the Walla Walla district of the Pacific Power & Light Company, has resigned after a period of service with the company covering almost thirteen years. He became identified with the company at Hood River in 1911, but later was transferred to the purchasing department in the Portland office. Subsequently he served as chief clerk in the Toppenish district, manager of the Sunnyside district and as manager of the Pasco-Kennewick district, with offices at Pasco. It was late in the summer of 1923 that he assumed the duties of the position he has just resigned. Mr. Safford is planning to leave shortly for the Pacific Coast.

C. E. Reese, who has been identified with the Philadelphia office of the Westinghouse Electric & Manufacturing Company as section head in the stoker sales and publicity department, was recently appointed general manager of the Bluefield (W. Va.) Gas & Power Company.

B. T. McCormick, formerly connected with the English Electric Company,

St. Catharines, Ontario, is now identified with the Wagner Electric Corporation, St. Louis.

O. R. Fahming, formerly associated with Dwight P. Robinson & Company, New York, has affiliated himself with Thomas E. Murray, Inc., consulting engineers, also of New York City.

M. L. Dunn, who was formerly associated with Louis T. Klander, consulting engineer of Philadelphia, is now with Day & Zimmermann, Inc., with offices in that city.

William A. Chamen, Engineer of South Wales

William Ashcombe Chamen, engineer and general manager of the South Wales Electrical Power Distribution Company and president of the South Wales Institute of Engineers, though

W. A. CHAMEN

an Englishman by birth, has been identified with Welsh commercial and technical circles for twenty years. Mr. Chamen was born at New Cross, Kent, in 1864 and was educated at Forest School, Walthamstow, Essex, which was connected with Kings College, London. When a youth he became associated with Crompton & Company, severing his connection with that organization seventeen years later to accept an appointment as corporation electrical engineer for the city of Glasgow, where he remained until 1905. On leaving Glasgow he joined the firm of Bramwell & Harris, consulting engineers, Westminster, who were at that time engaged in the laying out of the equipment of several electrical power undertakings, including that of the South Wales Electrical Power Distribution Company, to the management of which he was appointed. The company has made marked progress under the guidance of Mr. Chamen, whose achievements were recognized early this year when he was elected to the presidency of the South Wales Institute of Engineers.

Horace W. Gillett of Detroit, formerly chief alloy chemist of the Bureau of Mines, Washington, D. C., has been appointed chief of the metallurgical division of the Bureau of Standards to fill the vacancy created by the promotion of Dr. G. K. Burgess to the position of director of that bureau. Mr. Gillett, who is a graduate of Cornell University, holds a prominent position in the field of electrochemistry and is recognized as an authority on electrical furnaces. He is a former vice-president of the American Electrochemical Society.

Frederick Pope and **Alva O. Greist** have become associated as consulting and designing engineers, specializing in chemical, power and public utility work, with offices in New York City.

C. Heffner, formerly superintendent of distribution of the Oklahoma Gas & Electric Company at Sapulpa, has been transferred to Oklahoma City as assistant superintendent.

Richard W. Allen, who was formerly connected with the distribution engineering department of the Narragansett Electric Lighting Company, Providence, R. I., has been transferred to the Westerly (R. I.) Light & Power Company, which is controlled by the Narragansett company.

G. A. Paterson has been made general manager of the electrical properties at Brandon, Manitoba, which are under the control of the Continental Gas & Electric Corporation, Omaha, succeeding James B. Harvey, who recently resigned.

Hugh A. Brown, for the past three years sales manager of the Electro Dynamic Company, Bayonne, N. J., will sever his connection with that organization on March 17 to affiliate himself with the Otis Elevator Company. Mr. Brown was formerly associated with the Crocker-Wheeler Company and with the Burke Electric Company.

J. S. Ruble, vice-president in charge of construction of the H. K. Ferguson Company, engineers and contractors of Cleveland and New York, will sail from San Francisco on March 20 for Japan. Mr. Ruble will spend two months in the Orient to further the construction of an electrical engineering plant which the Ferguson company is erecting near Yokohama.

Frederick Dietrich, president of C. Brandes, Inc., and **C. E. Brigham**, chief research engineer of the organization, sailed for Europe on Saturday, March 8, on the *Berengaria* to visit the new plant of Brandes, Ltd., in England, where the Brandes "matched-tone" radio headsets are manufactured for sale in the British Isles and on the Continent.

Patrick F. Lyons has resigned as Middle Western district manager of the wire division of the United States Rubber Company, effective April 1. In 1899 Mr. Lyons became identified with the National India Rubber Company, which at that time was a subsidiary of the United States Rubber Company, as representative in the South and Middle West, and in 1911, when an office was established in Chicago, he became district manager there.

James B. Harvey, vice-president of the Continental Gas & Electric Corporation, Omaha, has resigned his position as general manager of the electrical properties at Brandon, Manitoba, which are controlled by the Continental Gas & Electric Corporation, to become sales manager of Otis & Company, bankers of Cleveland. Mr. Harvey has been associated with the Continental organization for more than ten years and has been prominent in the activities of the Nebraska Section of the National Electric Light Association, having served as vice-president and president.

C. C. Levis Elected a Vice-President of Byllesby & Company

C. C. Levis, manager of the New York office of H. M. Byllesby & Company, Inc., and Eastern representative of the organization, was recently elected a vice-president. Mr. Levis has been identified with the electrical industry since 1907, when he became affiliated with the General Electric Company and its allied interests in England. He

C. C. LEVIS

spent seven years in this connection, taking a two-year course in the works of the British Thomson-Houston Company, Ltd., and later handling the Far Eastern business of the company. In 1914 Mr. Levis joined H. M. Byllesby & Company, and he has since then been associated continuously with that organization with the exception of two years during which period he was in the United States Army.

Obituary

Urbin H. Rothschild, manager of the appliance department of the Merchants' Heat & Light Company, Indianapolis, for more than five years, died recently after an illness of two weeks. Mr. Rothschild was born in Clifty, Ind., sixty years ago.

Joseph Struthers, treasurer of the United Engineering Society and of the Engineering Foundation since the organization of its board in 1915, died at the French Hospital in New York on February 18. Mr. Struthers was born in New York fifty-eight years ago and had for many years been prominently identified with the metallurgical and mining engineering field. He had been secretary and treasurer of the Engineers' Club of New York since 1909.

Commission Rulings

Power Rate for Motion-Picture Theaters.—In settling a complaint made by motion-picture theaters against the Reedsburg municipal plant the Wisconsin Railroad Commission said that electrical energy for such theaters should be supplied at power rates when used for motion-picture machines and incidental power appliances, if the manager of the theater so arranges his wiring that separate circuits will be provided for these machines and appliances and for the regular lighting of the motion-picture theater.

Application of Rural Charge.—In a recent decision applying to a municipal electric plant the Wisconsin Railroad Commission said that the intent of the rural rate is to provide a charge which will take care of all the excess fixed charges and operating expenses due to the nature of the rural business and which will, when paid, place the rural consumer on exactly the same basis as an equivalent urban consumer and make the urban rate applicable. Six consumers on one side of a street who were outside the corporate limits but who were receiving service from the city's secondaries and from a transformer supplying other consumers at the regular urban rates should not be subjected to the rural charge, the commission declared.

Actual Results Entitled to More Weight than Judgment on Limited Knowledge. — In dismissing as unfounded a complaint from the Alpha Portland Cement Company that the rates of the Lehigh Navigation Electric Company and the Lehigh Valley Light & Power Company were excessive and discriminatory and their plants inefficiently managed, the Pennsylvania Public Service Commission defended the central-station companies (now merged into the Pennsylvania Power & Light Company), saying: "The nature and extent of the operating records show full recognition of the importance of constant study of operating conditions and results. The organization, the personnel and the methods of operation are such that one would expect the results to be well up to the possibilities of the station and therefore lend much weight to the actual results. The evidence shows that many of the suggestions of complainants' experts were in line with respondent's efforts or had been rejected by them after consideration and even trial. Others fall in the category of matters, concerning which there might be reasonable differences of opinion. The close identification of the operating staff of the Hauto and Harwood stations with the development of the type of stoker used in the Hauto station and with the use of small-sized anthracite coal in central-station work, and the results of repeated analysis and scrutiny by outside engineers representing the owners of the property, are additional factors lending much weight to the actual results as compared with judgment exercised after a more or less limited contact with the operation and study of its records. Respondent's net earnings available for depreciation and return for these years would appear to have offered every incentive to economy. The commission is of the opinion that there has not been any negligence or undue delay on the part of the respondent in installing improved facilities or any inefficiency of operation due to methods used or to incompetence or carelessness which would justify reducing the actual operating costs in determining the reasonableness of the rates."

Rural Service Rules.—Discussing an application from the United Utilities Company for approval of rate changes and ordering it to file new schedules, the Illinois Commerce Commission made several findings affecting rural service, as follows: (1) An electric rate schedule under which it is proposed to eliminate from consideration, in fixing the maximum demand, certain small motors used as auxiliary equipment by some consumers, and which would not be in service at the time that the main motors were in use, should contain definite provisions as to its method of application so that no doubt might exist in that particular. (2) Data showing an expected increase in revenues from a change in rural electric rates should be based upon the use for a full year rather than a three months' period. (3) A utility desiring to place in effect rules in regard to consumers' credit may not pick out certain sections of the general order of the commission and adopt the same, but must adopt the rules in their entirety. (4) A service reconnection charge filed without any limitation as to time is inequitable.

Drawing the Line as to When Extensions May Be Ordered Made.—The Public Service Commission of Pennsylvania thus dealt with unremunerative extensions in a case affecting the Hegins Water Company, its observations being made applicable to all utility companies: "In such cases there is justification for refusing to require the extensions to be made except upon some equitable basis which will be just to all parties concerned. This does not mean, however, that a public service company can arbitrarily refuse to serve all of its chartered territory, or serve only such parts of it as the company may voluntarily elect to do. Before an individual applicant or group of applicants within the chartered district should be denied service, it should appear that it cannot be furnished except at a loss which will necessarily operate to increase rates that would materially affect other ratepayers and impose upon them an undue burden, or which would so deplete the revenue of the company as to impair its ability to render adequate and efficient service. In such instances extensions may be ordered on terms and conditions which commend themselves to sound judgment and fair dealing."

Recent Court Decisions

Review of Michigan Commission Rulings.—The Supreme Court of Michigan, laying down the principle that an order of the Public Utilities Commission of that state is subject to review by certiorari, since the commission is not a ministerial body but an official board and its orders are of a quasi-judicial nature, declared further (in Rapid Railway Company vs. Commission) that the court will not refuse to consider the question presented, after petitioner has lost its right to review by bill in chancery by failure to file bill within the required time, on the ground that the writ was improvidently granted in view of petitioner's adequate remedy by bill in chancery. (196 N. W. 518.)*

Stay of Commission Rate Order Can Be Granted in New York Without Preliminary Trial.—Granting to the People's Gas & Electric Company of Oswego a certiorari order for the review of rates fixed by the Public Service Commission and their suspension pending such review, the New York Supreme Court said that such an order could be issued where it contained a specific finding based on evidence that great or irreparable damage would otherwise result to petitioner. The stay was conditioned on the company's executing an undertaking to repay with interest to its customers the amount collected in excess of the rate fixed by the commission in the event of this rate being eventually sustained. (202 N. Y. S. 700.)

Subscribers to Erection of Line Contracted for Through Committee Held Individually Responsible.—The Supreme Court of Colorado has upheld the validity of a contract entered into between the Jefferson County Power & Light Company of Golden, Col., and a list of subscribers represented by a committee appointed by them for the purpose of dealing with the company for the erection of a transmission line which was built according to the contract and is now in successful operation. The court held that recovery can be had directly against subscribers who fail to pay their subscriptions to such a committee. The committee in this instance had absolute authority to deal directly with the company and to solicit and collect subscriptions. In the case under review (Jefferson County Power & Light Company vs. Johnston) the subscriber refused to pay the amount of his subscription to either the committee or the company, and the latter brought suit. The defense contended that the proper action for the recovery of delinquent subscriptions was against the committee and not against subscribers. The power company recovered judgment in the lower courts which has now been affirmed by the whole appellate court without a written opinion.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Education in Lighting on a New Scale

School of Illumination with Demonstrations of All Classes of Lighting Established by National Lamp Works for Education of Electrical Men

By Ward Harrison
National Lamp Works, Cleveland, Ohio

LIGHT is the common denominator of all branches of the electrical industry, being the first point of contact with practically every class of customer—residence, commercial or industrial. Progress in the lamp industry is, therefore, of very general interest and concern, no matter whether it be a matter of engineering development or advance in the field of application or market building. The recent installation at Nela Park of what is virtually a complete school of lighting demonstration, which is to be used for the education of electrical men of all branches of the industry from all sections of the country, is therefore good news.

The lamp manufacturers for many years have been conspicuous pioneers in the instruction and training of electrical salesmen. Lamp demonstrations have been features of many a convention, and the spectacular progress of lamp improvement has been a fascinating story of which the entire industry has been closely observant. The fact remains, none the less, that, although many courses in lighting instruction have been given, no such organized effort has ever been possible embracing the entire subject, the full field of lighting in all its branches, in one complete course of study supported by a thorough practical demonstration of every application—a course to which men might come from central-station companies, jobbers, contractors, dealers and manufacturers of lighting equipment for substantial schooling.

New School of Lighting

Recently, however, the entire basement floor of the large sales building of the National Lamp Works at Cleveland has been transformed into a school of illumination. In the first class, known as the ninth illumination design course, held there from February 11 to 15 inclusive, seventy-seven men learned the fundamentals of selling lamps and lighting. These men, representing a cross-section of the electrical industry, knew that there is more to the lighting business than the mere selling of lamps. They knew that if they were qualified to design and specify good lighting for a customer, instead of selling lighting equipment for a hit-and-miss installation, they would increase their sales and build greater good will with their customers. They knew that if they understood the fundamental principles in the procedure of selling lighting they would again add to their ability to swing the sales curve sharply upward. After having attended this design school they are better prepared to work in their various fields.

Lectures and Demonstrations by Recognized Authorities

The list of registrants for the course included men representing central-station companies, jobbers, jobbers' salesmen, retail dealers, lighting-equipment manufacturers and other electrical interests as well as nine members of the International Lighting Mission. The course is held periodically three times a year. Lectures and demonstrations covering the theory and principles of lighting are given by recognized authorities in each field. Typical factories, offices and stores are visited and lighting layouts are designed for them. Street lighting, sign lighting and automobile lighting are also studied and demonstrated.

Lectures embracing merchandising principles, advertising and selling instruct the student how to use the knowledge which he has acquired. Contracts, sales rules, surveys of the various markets and the methods of developing them are discussed in order to aid every man to expand his business in his particular field. Having obtained a working knowledge of illumination, the student has effective sales ammunition at his command. Theory and practice are thereby joined to give a thorough training to the student.

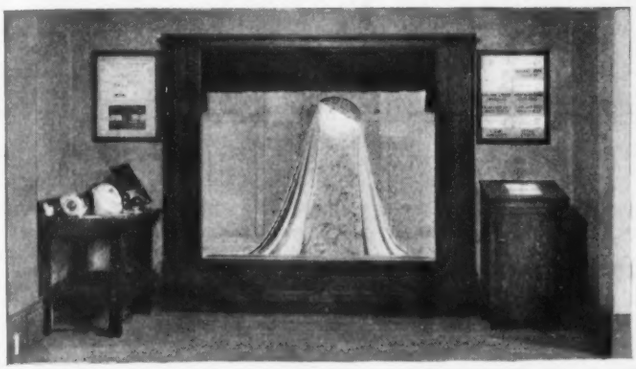
An Elaborate Equipment

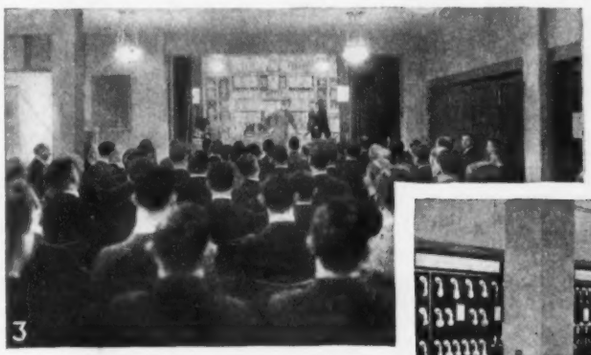
The newly completed demonstration rooms at Nela Park, used for the first time by this school, contain the whole lighting story in a nutshell. The demonstrations in these rooms helped those attending the course to visualize the facts and principles brought out in lectures in a way that could not be accomplished otherwise.

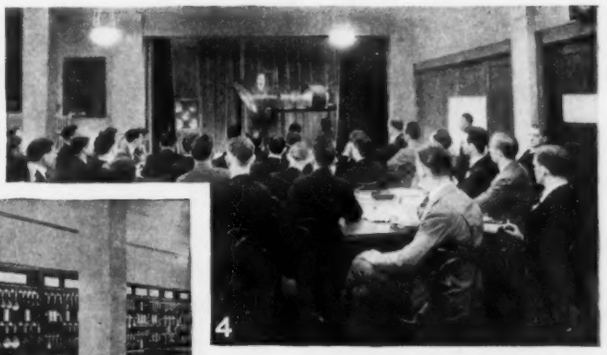
The entrance to the demonstration rooms leads into a reception room or lounge. Adjoining this room is a classroom which is equipped with special demonstration lighting fixtures, a stage for demonstration purposes, tables equipped with individual drawers for each student's books, papers and working materials, and demonstration booths along the sides of the room showing the most up-to-date lighting equipment. Individual rooms containing equipment for the demonstration of industrial lighting, home lighting, street lighting, automobile lighting, show-window lighting, sign lighting and sales helps enable the student to obtain in a short time a most comprehensive idea of the modern methods of lighting and to grasp the contrast between good lighting and bad.

It is exceedingly difficult to picture the immense possibilities of light as applied in the various fields, and yet a full comprehension of the market and its dependence upon proper selection and installation of lamps is vital to any man who is to develop lighting business in a big way. These demonstration rooms serve admirably to span the gap between imagination and realization. They give to the salesman a balanced viewpoint on the subject of lighting

Features of the Lighting School at Nela Park







THE demonstration equipment installed in the new school of illumination established by the National Lamp Works embraces practically every type of illumination, including (1) an automatic show window lighting exhibit, (2) a presentation of variety and character in electrical advertising, (3) a classroom with a stage, where a play cast in an electric shop is put on, (4) lectures on light flux and other practical subjects, (5) a "living catalog" of all types and sizes of lamps, (6) an industrial lighting demonstration with lamps and reflectors adjustable to varying heights, (7) a comparative test of commercial lighting, and (8) a study of street lighting. There is a large central lounge (9), and numerous smaller exhibits of automobile lighting, surgical lighting and other special applications.

and fit him to recognize the many opportunities that lie at hand for the interpretation and sale of more adequate and effective lighting in any community. To have this source of instruction and inspiration made available to electrical men from all parts of the country cannot help to have a very stimulating effect upon lighting development from which the entire industry will directly or indirectly benefit.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

ALTHOUGH purchasing by the light and power companies continues to be the strongest element in the electrical market, it has been recognized that the demand has largely shifted from heavy generating equipment to secondary apparatus for distribution and utilization of power. Most producers of heavy apparatus have been booked up to capacity for the entire year, and as a natural consequence orders in this field have fallen off. Attention is now being centered on the securing of apparatus to build and equip transmission and distribution lines for interconnection and service. Industrial buying continues in the main somewhat inactive, the bulk of the business at present being for smaller equipment. Collections throughout the country, except for the Pacific Coast, as reported for February are not quite so good as in January. In St. Louis collections so far this month have shown an improvement over last month.

In New England electric supplies are moving actively, there is strong demand for central-station service, and utility expansion continues to be the most active support to the market. The demand for industrial equipment is considered fair in New York, and much secondary apparatus is being purchased by utilities, with transmission material very prominent. In the Southeast, although industrial buying has slackened, the large building construction so far this year and the outlook have created an optimistic attitude. A quiet week has been reported in the Middle West, although the volume of business still remains good. On the Pacific Coast there was an active demand for the new standardization switches and branch cut-outs recently approved by local boards, and there was a noticeable increase in motor sales as a result of the stimulus of the pumping season.

Wire Advances Following Copper Increases—Demand Good

AT LEAST four wire manufacturers advanced their prices during the past few days and more are expected to follow, in line with the recent advances in the copper market. There is keen price competition in the smaller sizes of wire as they are made by many manufacturers; in fact, it is persistently reported that there are some smaller manufacturers who are responding to the demand for cheap wire and are shipping wire below code standard bearing the code label but never inspected or tested. The general demand for the smaller sizes tends to be good, although somewhat spotty, with one manufacturer reporting an increase in the demand for larger sizes. Active automobile manufacturing has created a strong demand for insulated wires used in that industry.

At the present time eleven territories either have approved or have under consideration local rulings requiring lamp cord to be marked for polarity. Just why this should be necessary is somewhat of a puzzle to manufacturers. The beauty of a silk lamp cord will certainly be marred by a polarity marker, the necessity of which is questionable.

Foreign Transmission-Tower Steel Available in American Market

FOREIGN transmission-tower steel is available in the American market at the present time for approximately 1 cent per pound less than the domestic product. The material is delivered fabricated, but the galvanizing is done in America as it is believed that a better job can be obtained in this way. A large utility company recently placed an order with an American manufacturer for 5,000 tons of steel to be used in constructing a 115-mile transmission line. The manufacturer is furnishing this foreign steel to fill the order.

Wiring-Device Demand Gaining

REPRESENTATIVE manufacturers of wiring devices report a well-distributed increase in demand for these products compared with last year at this time, with cost and price conditions reasonably stable. Raw materials are in plentiful supply and labor is easy to obtain. As business during the last quarter of 1923 was excellent, jobbers did not accumulate much stocks, and consequently buying by distributors is in better volume. Leading houses report that sales are ahead of last year, with one manufacturer running about 30 per cent above the sales of the last month of 1923. Most manufacturers are building up factory stocks to meet the spring trade. Export business is rather unsatisfactory in the ordinary lines of staple wiring devices, with the possible exception of heavy-duty range switches. New designs are being brought out to increase the facility of electric service, and both manufacturers and jobbers look forward to a good year. In a notable instance one company reported that January was the best month in sales that it has ever recorded.

February Delinquent Electrical Accounts Increase

IN THREE of the territories reporting to the National Electrical Credit Association the number of delinquent accounts, the total amount and the average amount increased in February, 1924, over January of the same year. In both the Philadelphia and New England territories the number of delinquent accounts for February, 1924, increased sixty-one and five respectively over January, and the average amount increased slightly. On the Pacific Coast the February, 1924, delinquent accounts listed only nine, as against fifteen last year. The table gives the total list.

DELINQUENT ACCOUNTS IN FEBRUARY

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
Jan., 1923	809	$88,811.52	$109.78
Jan., 1924	643	104,657.18	162.76
Feb., 1923	635	69,996.47	107.49
Feb., 1924	821	89,621.45	109.16
New York:			
Jan., 1923	392	54,452.00	139.00
Jan., 1924	248	40,799.00	164.00
Feb., 1923	283	35,045.00	127.00
Feb., 1924	365	54,688.00	150.00
Philadelphia:			
Jan., 1923	216	32,449.17	150.23
Jan., 1924	197	22,760.53	115.54
Feb., 1923	176	26,881.67	152.73
Feb., 1924	258	31,825.03	123.35
New England:			
Jan., 1923	66	7,805.66	118.27
Jan., 1924	28	3,948.95	141.03
Feb., 1923	48	2,495.35	51.99
Feb., 1924	33	4,789.14	145.12
Pacific Coast:			
Jan., 1923	12	1,087.20	90.60
Jan., 1924	19	1,896.43	99.81
Feb., 1923	15	4,245.63	283.04
Feb., 1924	9	1,072.04	119.11

Utilities Still Actively Supporting Market in New England District

PRICES have been firm in the electrical markets in New England this week without much change. Buying of luxuries on easy payments seems to be a marked tendency for the time being, and consumers are giving some trouble to retailers on slow collections. Collections in general are not quite so good, although money is plentiful. Electrical supplies are moving actively, however, with the demands of the public for central-station service lending an important stimulas to the total business.

Public utility expansion continues to be the most active support to the market. The New England Telephone & Telegraph Company has announced a construction budget of $29,000,000 for 1924. Pole-line hardware, washing machines, small motors, lamps and wiring devices are selling in excellent volume. Appliance stocks are rather large for the moment. Utility syndicate companies report good gains in appliance sales over a year ago, and quotas are being increased 20 per cent or more for 1924. The only serious shortage was reported on Tuesday in radio tubes.

The building industry has not hit its Spring stride as yet with respect to electrical materials. A decided spurt in the sale of tape has been reported. Maine is absorbing loom in fair quan-

tities, and central New England is buying more flexible armored conductor and rigid conduit. All buying is conservative, however, being confined chiefly to immediate needs.

Healthy Optimistic Attitude Prevails in New York District

PURCHASES made in the New York district are now largely confined to secondary apparatus for utility companies such as power transformers, switchboards, motor-generator sets, oil switches, switching equipment, rotary converters, etc. There is a particularly large demand for oil switches and switchboards, with the result that deliveries are not improving as was expected when increased manufacturing facilities were provided for these lines. This activity of the utilities is reflected throughout the state even in the companies that are considered weak. Much high-voltage transmission line work is being planned at present. Some large purchases for towers have already been made and many inquiries are in the market.

The demand for industrial equipment is fair, the smaller sizes of motors being most prominent. Stocks are in good shape and deliveries are considered satisfactory. Buying is still on a conservative basis. Plenty of railway work is at present being planned, and increased activity is looked for in this direction. The volume of sales among the jobbers is considered very good but sales are made on small margins owing to the keen competition. There is a strong tendency to sell staples very close to cost. Radio is still of outstanding interest, with the shortage on tubes remaining evident.

Building Construction in Southeast Creates Optimistic Attitude

A GENERAL spirit of optimism prevails throughout the entire Southeast, though industrial activities are not so satisfactory as was anticipated. This optimism is based upon the general business outlook and is in no small measure a reflection of the construction started in the month of February. The value of building contracts in North and South Carolina, Tennessee, Georgia, Florida, Alabama, Mississippi, Arkansas and Louisiana for February amounted to $40,664,700. This figure is under that of the same month last year, but the cumulative total for 1924 is 6 per cent over a similar period in 1923. The high price of cotton combined with the low price quoted on the finished product has resulted in a slowing down of expansion plans in this industry. Construction work on commercial and residential buildings has served to hold up the demand for the 5-amp. and 10-amp. meters, with a reasonable taking of the polyphase types. High-tension metering equipment is very active, most of the sales going into central-station work with a scattering here and there for industrial plants which have recently been electrified.

Considerable interest is being evidenced in improved lighting in the home. A number of the utilities either have just completed, are starting or have under way kitchen-lighting campaigns, while merchandising by central stations has caused a brisk demand for heating devices of all types. Atlanta, Savannah, Chattanooga and Tampa have recently adopted a universal standardization of safety switches, and this, of course, has caused a heavy demand for this equipment. House wiring on the deferred payment plan is causing considerable activity in wiring materials and devices, with the outlook bright for increased volume as spring opens up.

Price Changes Features of Quiet Middle Western Buying

THE week has been quiet in the electrical trade in the Middle Western territory, although the volume of business still remains good. However, general optimism is expressed as to the business outlook for March. There have been no outstanding incidents of the week, although orders for over one-half million dollars' worth of incandescent lamps were placed this week for delivery during the second quarter of the year. This is not unusual, however, for this time of the year. Central-station purchases continue to be active and tend to improve general conditions.

Switchboard and mining-machine cable prices were revised this week by one manufacturer. The smaller sizes of wire advanced approximately 2 per cent; and the larger 6 per cent. Conduit prices also advanced slightly. For several years invoices have been so rendered by the manufacturers that the extra discounts beyond the Pittsburgh basing card have been applicable to the freight included in the base price. This method has been wrong in principle, as it has allowed a discount on the freight. To remedy this manufacturers have adopted a so-called simple discount schedule, which increases the price about 5 per cent, or in the neighborhood of $50 per car. Armored-cable prices remain at the same low level, although every manufacturer is aggressively endeavoring to increase their volume of business in this commodity. Still, the demand remains rather sluggish. Unfavorable weather conditions have somewhat retarded construction work.

Good Business in St. Louis—Prices Steady and Stocks Ample

BUSINESS conditions in St. Louis and the surrounding territory during the past thirty days compared very favorably with the same period last year. The consensus of opinion among business men seems to be that the year 1924 has had a very good start. In electrical lines there has been a good demand for high-tension equipment and for motors for industrial purposes, and probably because of this fact there has been an increased demand for pole-line hardware and for general supplies used by central stations.

Manufacturers and jobbers are preparing for a big business in electric fans during the coming season, and a number of well-defined fan campaigns are well under way. The demand for radio equipment continues to be good. Dealers complain of difficulty in keeping up with the new developments and of having obsolete equipment left on their hands which is of little value.

The demand for household electrical appliances has been exceptionally good for this season of the year, as have sales of washers and cleaners. An increasing interest is apparent in the use of electric refrigerating apparatus for domestic purposes and also of decorative lamps and irons.

The manufacturers and jobbers have all had their annual sales conferences, and their sales departments are all set for doing a record business during the year. Except for a slight increase in copper, prices are in general steady and stocks are fair with a satisfactory demand. Collections have shown a marked improvement over last month.

Large Orders Placed on Pacific Coast—Motor Sales Strong

THE electrical trade on the Pacific Coast was very much interested last week in the active demand for the new standardization switches and branch cut-outs recently approved by nearly all local boards. This demand sprang up apparently over night, and stocks are being rushed from the factories. Motor sales have been excellent, principally as a result of the stimulus of the pumping season. Just what effect this volume of business may have on the dealers' collection records is problematical, for the farmers of the Coast have felt the acute pinch of the drought. Despite a certain amount of worry over the water-shortage situation and its natural consequences in California, February building permits in San Francisco, Oakland and Los Angeles show large gains over last year and indicate an uninterrupted building program.

The copper advance is now reflected in insulated wires and wire is trending upward. The lamp-cord market has been good, especially on silk cords in assorted colors and styles. The tendency has been toward the buying of smaller low-voltage wire. Coast stocks of wooden pins and brackets are high in expectation of good orders for spring construction. An annual cross-arm contract of about $100,000 from a San Francisco company will shortly be submitted to bidders. A 300,000-lb. bare-copper-wire order was recently placed by the Southern Pacific Company for its dispatching circuit from Los Angeles to El Paso, and many more railroad orders on the same scale for wire, supplies and specialized signaling equipment are expected within the next sixty days.

The Metal Market

PRICES of the non-ferrous metals moved within a narrow range during the past week, which has been a quiet one. Copper and tin are somewhat higher, but lead and zinc have shown slight declines. There is every prospect that consumption in this country will be maintained at the same high rate as last year.

NEW YORK METAL MARKET PRICES

	Mar. 5, 1924 Cents per Pound	Mar. 12, 1924 Cents per Pound
Copper, electrolytic	13¾–13⅞	14
Lead, Am. S. & R. price	9.00	9.00
Antimony	11⅛	11⅛
Nickel, ingot	26–30	26
Zinc, spot	7.05	6.85
Tin, Straits	56¼	58¾
Aluminum, 98 to 99 per cent	27	27

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Electric Controller & Manufacturing Announces Changes

At the annual meeting of the Electric Controller & Manufacturing Co., Cleveland, a number of changes were made in that organization. Claiborne Pirtle, formerly president, was elected chairman of the board of directors; H. F. Stratton, who has been vice-president and chief engineer, was elected president; F. R. Fishback, who was sales manager, was elected vice-president and secretary; P. C. Clark, formerly secretary and treasurer, was elected vice-president and treasurer; R. G. Widdows, who has been manager of the New York office, was appointed sales manager, and D. C. Wright was appointed chief engineer. These men have all been with the company for fourteen years or longer.

Raymond Brothers Engineering Moves Sales Offices

The Raymond Brothers Engineering Company, Chicago, designer of pulverized-fuel systems and manufacturers of machinery and equipment for preparation and utilization of pulverized coal, announces the removal of its general sales office to the Combustion Engineering Corporation building, 43 Broad Street, New York. H. D. Savage, vice-president and general manager Combustion Engineering Corporation, will be in charge of sales, and all inquiries relative to "Rayco" systems and equipment should be directed to the New York office.

Boston Jobber Suffers Fire Damage

Fire in the warehouse of the George H. Wahn Company, electrical supply jobber, Boston, on Tuesday of this week damaged the electrical stock of the organization by about $15,000, including injuries from water, according to preliminary estimates. The major damage from fire was on the fourth floor, where there was a considerable lamp stock. The direct losses are covered by insurance.

Westinghouse Builds Largest Turbine-Driven Generator

The largest turbine-driven generator ever built has been completed recently by the Westinghouse Electric & Manufacturing Company at its East Pittsburgh works. This is a part of two 62,500-kva. tandem-compound turbine-generator units ordered by the Brooklyn Edison Company for its Hudson Avenue station.

When the rotor of this huge generator was shipped from East Pittsburgh it was mounted in a wooden crib that weighed 15,000 lb. and placed on a special flat car for shipment. The speed of the car was limited to 8 miles an hour and a devious route was necessary to avoid certain bridges. The stator of the generator was built in two sections and did not therefore present such difficulties in its transportation. It was assembled at the Hell Gate station of the United Electric Light & Power Company and floated down the river to Hudson Avenue.

H. G. Weeks Manufacturing Moves to New Building

The H. G. Weeks Manufacturing Company, Hamilton, Ohio, manufacturer of cooking and heating appliances, has moved to a new factroy on Bell Avenue. This building is of glass and concrete with double the floor space of the old one. It has excellent trackage and railroad facilities for carload shipments.

Increased business has made this removal necessary, according to Mr. Weeks, and in order to take care of this expansion the capitalization of the company has been increased from $100,000 to $300,000. The old factory has been sold.

Illinois Wire & Cable Building New Plant on Pacific Coast

The Illinois Wire & Cable Company, Sycamore, Ill., has purchased a six-acre tract of land at Oakland, Cal. This property, situated on both the Western and Southern Pacific Railroads, will be the site of a complete and modern mill for the manufacture of electric wires and cables.

Building plans have already been approved and construction of the first unit of approximately 30,000 sq.ft. will commence immediately, with the expectation of commencing actual manufacture within the next ninety days. The personnel for the operation of the various units has already been selected.

Trenton Electric Supply Company Under New Management

O. Fred Rost, general manager Newark Electrical Supply Company, has been elected president and general manager of the Trenton Electric Supply Company, Trenton, N. J. having just become a majority stockholder in that company. The Trenton company will be reorganized and will solicit business in the southern New Jersey territory.

Mr. Rost also recently purchased the Hudson Electrical Supply & Equipment Company, Jersey City. The purchases of the Hudson and Trenton companies do not in any way involve the Newark Electrical Supply Company, nor do they affect the responsibilities or activities of Mr. Rost in connection with the Newark company.

The Jeffrey Manufacturing Company, Columbus, Ohio, is building a large three-story office building which will afford a more efficient layout of offices and permit more effective handling of business. In addition, the company is increasing its number of manufacturers' agents, who will carry their own stock.

The General Electric Company announces that the headquarters of the East Central district was moved on March 1 from Cincinnati to Cleveland and combined with the local Cleveland office in the new Union Trust Company building, where more than 15,000 sq.ft. of floor space will be occupied.

The Western Electric Company has leased space for a two-story building at Wood and Austin Streets, Dallas, Tex., to be constructed by local interests. It will be 100 ft. x 100 ft., with foundations arranged for two additional floors later, estimated to cost $65,000. It will be equipped as a factory branch and general distributing works for this district. The company will remove its present branch on Pacific Avenue, near St. Paul Street, to the new building as soon as it is ready for occupancy.

The Indiana Electric Supply Company, Capitol Avenue and Washington Street, Indianapolis, has leased the three-story building at 120 South Pennsylvania Street and will occupy the structure at an early date. The present establishment will be removed to the new location and considerably enlarged.

The William Ganschaw Company in 1923 improved its dredge, hoist, crane and machine-tool business about 25 per cent over that of 1922, according to C. F. Goedke, secretary. Mr. Goedke further says that he sees no reason why 1924 should not equal the volume of business obtained in 1923.

The Pittsburgh Transformer Company, Pittsburgh, Pa., recently secured through its agents, Eicher & Bratt, Seattle, Wash., a contract to supply the Long-Bell Lumber Company, Longview, Wash., with the following transformers: Three 2,000-kva., 66,000-13,200-volt step-up; three 1,500-kva., 66,000-13,200-volt step-down; twelve 833-kva., 13,200-230/460-volt; three 500-kva., 13,200-115/230/460-volt; six 100-kva., 13,200-115/230/460-volt.

The Benjamin Electric Company, Chicago, has had plans prepared for alterations and improvements in its four-story and basement plant at 213 South Green Street, to cost approximately $40,000.

The U. S. Light & Heat Corporation, Ltd., Niagara Falls, Ontario, has recently leased a factory very much larger than its former plant, which was burned down. The company is now in production in the new works.

The Globe Electric Supply Company, Denver, is now representing Holophane reflector products in the Rocky Mountain region.

The Mine & Smelter Supply Company, Denver, has reorganized its electrical supply activities with the establishment of a Westinghouse department, under the direction of Thomas J. Yonley, co-ordinating with the electrical department headed by A. E. Bacon.

The **American Blower Company**, Detroit, is now manufacturing a unit type of heater suitable for industrial buildings, warehouses, etc., which is known as the "Venturafin." The unit heater consists of an automobile-type radiator through which air is circulated by means of a motor-operated fan.

The Crucet Manufacturing Company, manufacturer of lighting fixtures and portable lamps, 292 Fifth Avenue, New York, has purchased a five-story loft building at 18 West Twenty-third Street and will occupy the two upper floors.

The M. S. Wright Company, Worcester, Mass., has appointed the Maytag Intermountain Company, 47 East Third Street, Salt Lake City, Utah, as distributor in the Intermountain territory for its "Sweeper-Vac."

The Westinghouse Electric & Manufacturing Company has received an order from the Los Angeles Gas & Electric Company for central-station equipment to cost $500,000.

The Safety Electric Products Corporation, 1330 East Sixteenth Street, Los Angeles, Cal., has plans completed for the construction of a new one-story plant in Sixteenth Street, near Central Avenue. It will be 95 ft. x 250 ft. and will be equipped for the manufacture of electrical specialties. It is estimated to cost approximately $55,000.

The Steel City Electric Company, Pittsburgh, is sending to contractors throughout the country a trial order blank for a general assortment of popular quick-moving products of its manufacture. This trial order is being offered at a saving of 28 per cent.

The Ward Motor Vehicle Company, Mount Vernon, N. Y., has sold to the Corby Baking Company, Washington, D. C., ninety new trucks to be added to its fleet of Ward "electrics," making 106 in all. Electric truck performance was thoroughly tested out with the original sixteen Ward trucks and as a result the additional ninety were purchased.

New Equipment Available

Short Descriptions of New Apparatus and Accessory Equipment of Interest to the Electrical Industry and Available from Manufacturers and Announcements of New Lines

Switchboard Instruments

A complete line of rectangular-shaped instruments, including direct-current voltmeters and ammeters, for use on switchboards controlling alternating-current machines has been developed by the Weston Electrical Instrument Company, Newark, N. J, All the instruments of the group have uniform-case size dimensions—5¾ in. wide and 6 in. high. This affords a remarkable saving in space which has been attained without sacrificing any of the essential characteristics of the Weston round-pattern instruments. In the case of the rectangular instrument, four may be laterally accommodated on a 24-in. panel, whereas the round pattern instruments require a 32-in. panel and a greater vertical space. The ratio of space is approximately five to nine in favor of the rectangular case. A triplex ammeter, as shown in the illustration, contributes to the saving in space where an ammeter is required in each phase.

Although the new instruments occupy a much smaller space, reference to the illustration shows how it was possible to preserve the same scale length as in the round-pattern instruments. Further, there has been obtained a much larger scale opening, permitting better illumination and improved legibility, which is also facilitated by larger and heavier scale numerals printed on a horizontal plane. The wiring studs in the rear of the instrument have been grouped in the center and have been kept uniform on all types, so that any instrument with an equal or lesser number of studs than another can replace it without requiring new drilling. Resistors, where used, are mounted back of the switchboard on studs projecting from the rear of the instrument. These resistors have also been made correspondingly smaller.

New Rectangular-Shaped Switchboard Instruments

Left—Wattmeter, and ammeter with cover removed.

Center—New instrument superimposed over round pattern showing scale openings and how same scale length was preserved.

Right—Triplex ammeter.

Heavy Duty Portable Cord

A heavy-duty portable cord with unusual tensile strength has been developed by the United States Rubber Company, 1790 Broadway, New York, for use under severe conditions. The No. 18 size will withstand a direct pull of approximately 400 to 450 lb. It contains forty-one strands No. 34 B. & S. gage copper wire and has polarity identification through the color of the compound used. The two conductors are twisted together and the interstice filled with cotton yarn to make it round. A light braid is then applied, and a special rubber compound is used for the outer jacket.

Electric Hammer.—A new and lighter model, "type F," "Syntron" electric hammer has been developed by the National Electric Manufacturing Company. It weighs only 9 lb. and is especially adapted for some of the lighter forms of work. The principle of this hammer is the same as that of other "Syntron" hammers in that it has only one moving part, a reciprocating piston which moves in synchronism with the alternations of the electric current. If only direct current is available, a small rotary converter is provided.

Grounding Device.—An aluminum solderless grounding device has been developed by the Veco Manufacturing Company, South Norwalk, Conn. The device is similar to a lock nut with a projecting clamping device in which the ground wire is fastened. When threaded on a conduit it becomes an integral part of the conduit system. It is manufactured in sizes ranging from ½ in. to 6 in.

Arch-Type Electric Furnace.—An arch-type electric furnace requiring no muffles and especially adapted to the needs of manufacturers of jewelry and other metal products has been developed by C. I. Hayes, 194 Friendship Street, Providence. The heating element is supported on refractory arches built in sections of uniform size and shape, the number of sections depending on the length of the furnace. The absence of muffles contributes toward greatly reduced renewal costs.

Lava Tubular Resistance Unit.—A tubular resistance unit for heating bookbinders' tools, stamping machines, etc., is being manufactured by the Dalton Electric Company, 164 Federal Street, Boston. Stranded "Nichrome" or "Chromel" wire leads are brought out of either or both ends of a lava tube into which resistance wire has been cemented into position. The exterior is non-corrosive and non-metallic. The completed unit is easily inserted into any piece of machinery.

New Trade Literature

SUPERVISORY CONTROL.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a circular, known as C-1,694, entitled "Supervisory Control," in which the general principles of operation and construction of both audible and visual systems of supervisory control for automatic substations are given.

TRANSFORMERS.—The Packard Electric Company, Warren, Ohio, has issued a bulletin showing the "Packard" power transformers, and particularly the method of bracing and provision for ample ventilation and circulation of cooling oil.

PUMPING EQUIPMENT.—The De Laval Steam Turbine Company, Trenton, N. J., is distributing a leaflet which describes and illustrates the "De Laval" pumping equipment in the waterworks pumping station of the city of Allentown, Pa.

TUBE MOVEMENT.—The Foxboro Company, Inc., Foxboro, Mass., is distributing bulletin No. 154, covering the improved "Helical" tube movement.

LIGHTING SPECIALTIES.—The F. W. Wakefield Brass Company, Vermilion, Ohio, has issued a new folder describing its "Red Spot" hangers equipped with various urn-shaped glassware.

LINE MATERIAL.—The Line Material Company, South Milwaukee, Wis., is distributing a folder entitled "The House That Jack Built," a new version of the famous rhyme, by "Lineman Link," in which attention is called to devices for line work.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase and agency is desired in Toronto, Canada (No. 9,412), for portable electric hammers or drills.

Purchase and agency is desired in Santander, Spain (No. 9,439), for electrical machinery and railway materials.

An agency is desired in Rome, Italy (No. 9,392), for radio-telephone receiving sets suitable for wave lengths of 400 to 600 meters and 400 to 4,000 meters and ranges varying from 10 miles to 2,000 miles.

Purchase and agency is desired in Malaga, Spain (No. 9,417), for ice-making and refrigerating machinery for hotels and restaurants.

ELECTRICAL EQUIPMENT FOR AUSTRALIAN RAILWAYS.—Tenders will be received by the New South Wales Railways Commissioners until May 21 for electrical equipment for 150 motor cars, including motors, controllers, air compressors, pantographs, etc., and 150 trail cars.

AUTOMATIC TELEPHONE EQUIPMENT FOR SYDNEY, AUSTRALIA.—Tenders will be received by the Postmaster-General's Department, Sydney, Australia, until May 22 for automatic battery telephone equipment.

BIDS FOR EQUIPMENT FOR STATE ELECTRICITY WORKS, MONTEVIDEO, URUGUAY.—Bids will be received by the State Electricity Works, Montevideo, Uruguay, until April 30 for six generating sets, including Diesel engine directly connected to generator, with accessories and spares.

Foreign Trade Notes

ELECTRIC POWER TO BE USED FOR PROPOSED STEEL PLANT IN BRAZIL.—The proposed new iron and steel plant to be constructed by the Brazilian government in the Doce River Valley in the State of Minas Geraes, *Commerce Reports* states, will be operated by electricity. This is one of the three plants being erected under the terms of a decree promulgated January 19, 1924.

EXTENSION OF TELEPHONE SERVICE IN INDIA.—Following the development of a trunk telephone service between Bombay and Delhi, the Indian government authorities, according to *Commerce Reports*, are engaged in preparing schemes for wider extensions of trunk lines connecting all the main cities and towns in India. The first connection to be made is between Bombay and Calcutta, which will be completed by December, 1924. Following that connections will be made between Calcutta and Delhi and Calcutta and Madras.

LONG-DISTANCE TELEPHONE LINE IN CHINA.—Arrangements are being made, *Commerce Reports* states, for the completion of a telephone toll line between Shanghai and Nanking under the direction of the Ministry of Communications.

PROPOSED IRRIGATION AND HYDRO-ELECTRIC DEVELOPMENT IN SPAIN.—Plans are being considered by the officials of Murcia, Alicante and Cartagena, Spain, according to *Commerce Reports*, for an irrigation and hydro-electric project calling for an expenditure of about 90,000,000 pesetas (at present rate of exchange the peseta is worth $0.12). The project includes the construction of a dam and irrigation. The water is to be used for hydro-electric power developments, irrigation purposes and water supply for these cities. It is also reported that there are good prospects of the Spanish government making material guarantees to assist the venture. Further information may be obtained on application to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its district offices, by referring to No. Spain 35x-e.

New Incorporations

THE GRAYSVILLE (TENN.) LIGHT & POWER COMPANY has been organized with L. O. Morin president and R. Guy secretary. The company proposes to erect a 5-mile transmission line.

THE MISSOURI POWER & LIGHT COMPANY, Mexico, Mo., has been organized to take over the properties of the Missouri Utilities Company, Mexico; the Jefferson City (Mo.) Light, Heat & Power Company and street-railway system; the North Missouri Light & Power Company, Hannibal, and the properties of the North American Light & Power Company in Oklahoma and Ohio. The officers are: Clement Studebaker, Jr., president; W. A. Baehr, E. R. Locke and H. L. Hanley, vice-presidents; Scott Brown, vice-president and secretary, and P. C. Dings, treasurer.

THE MISSISSIPPI POWER COMPANY, Portland, Me., has been organized to generate and transmit electricity outside of the State of Maine. The capital stock consists of 2,500 shares of no par value. The directors are: M. F. Foster, South Portland, president; A. B. Farnham, Portland, treasurer, and J. B. Weakley, Boston.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

HUDSON, MASS.—The Marlboro (Mass.) Electric Company has submitted a proposal to the Commissioners of Public Works offering to purchase the municipal electric light and power plant.

MONSON, MASS.—The Rubwood Wheel Company, Inc., plans to build a steam-operated electric power plant at its works, to cost about $50,000.

PAWTUCKET, R. I.—The Blackstone Valley Gas & Electric Company plans to increase its capital from $8,000,000 to $16,000,000, part of the proceeds to be used for extensions to its system.

GEORGETOWN, CONN.—The Gilbert & Bennett Company plans to build a substation at its local wire goods plant in connection with a factory extension, to cost about $100,000. Greenwood & Noerr, 847 Main Street, Hartford, are engineers.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by William H. Gompert, architect Board of Education, Flatbush Avenue Extension and Concord Street, Brooklyn, until March 25 for general construction, including heating, plumbing, electrical work, etc., for a temporary school building, to be known as Public School 96, at Lincoln Avenue and Rockaway Road, in South Ozone Park, Borough of Queens.

GOUVERNEUR, N. Y.—Plans have been prepared by the Board of Village Trustees for the construction of a 200-hp. hydro-electric plant, for which $100,000 in bonds have been voted. The plans also include high and low-tension distribution systems and an ornamental lighting system. L. C. Reynolds, Geneva, is consulting engineer.

LIVINGSTON, N. Y.—The New York State Gas & Electric Corporation is reported to have purchased the properties of the Livingston Manor Electric Company and the Callicoon Independent Electric Company and will consolidate them with the Tri-County Light & Power Company a subsidiary of the purchasing company. Arrangements are being made for a bond issue of $850,000, the proceeds to be used for additional transmission lines in the Adirondack and Delhi sections.

NEW YORK, N. Y.—An appropriation of $50,000 has been granted the Department of Plants and Structures, Municipal Building, for the installation of a radio broadcasting station for municipal operation.

NEW YORK, N. Y.—The Consolidation Coal Company, 67 Wall Street, contemplates the installation of electric power and other equipment at its properties.

NEW YORK, N. Y.—The Transit Commission, 49 Lafayette Street, is preparing plans for the erection of an electrical repair shop at the Coney Island yards of the municipal rapid transit system, to cost about $500,000. Bids, it is understood, will soon be asked for.

WATERTOWN, N. Y.—The International Paper Company, it is reported, is considering plans to convert its three local paper mills into power plants.

BROWNS MILLS, N. J.—The Borough Council has received authority from the Board of Public Utility Commissioners to purchase the property of the Browns Mills Electric Light & Power Company, to be owned and operated by the municipality. Extensions to the plant and distributing system are contemplated.

HAMMONTON, N. J. — The Water Commission contemplates the installation of two electrically operated pumping units, compressors, etc., to cost about $14,000.

JERSEY CITY, N. J.—The Public Service Electric Company has filed plans for the construction of a substation at 153-44 Culver Avenue, to cost about $40,000.

DILLSBURG, PA.—A company is being organized to secure electrical service for farmers and residents in the vicinity of Aspers and Center Mills. The transmission lines of the Cumberland Valley Heat & Power Company will be extended from Aspers to Center Mills.

FRACKVILLE, PA.—The Philadelphia & Reading Railway Company has preliminary plans and surveys in progress for the electrification of its line from St. Clair to Frackville, to cost about $1,500,000.

LEBANON, PA.—Steps have been taken by the Chamber of Commerce to secure improvements to the street-lighting system.

PHILADELPHIA, PA.—Electric power equipment will be installed in the proposed plant addition to be erected by the Publicker Commercial Alcohol Company, Swanson Street, at Delaware Avenue and Bigler Street, to cost about $750,000.

PHILADELPHIA, PA.—Bids will be received by the Philadelphia Electric Company until March 17 for the construction of an addition to its substation at Sixty-fifth and Paschell Streets. The equipment installation will soon be arranged.

PITTSBURGH, PA.—The Hubbard Company has engaged H. O. Swoboda, consulting engineer, Empire Building, Pittsburgh, to prepare plans for a new industrial substation.

POTTSVILLE, PA.—Plans for the new water system to be built at Indian Run by the Pottsville Water Company, to cost about $1,000,000, provide for the installation of electrically operated pumping machinery.

UNIONTOWN, PA.—The Middleburg Light, Heat & Power Company is negotiating for the purchase of the properties of the Uniontown Public Service Corporation and the Lower Mahanoy Public Service Corporation. The systems will be consolidated and extensions made to transmission lines.

BALTIMORE, MD.—The United Railways & Electric Company is planning to build four automatic substations, to cost about $600,000.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company has been granted a permit to construct a substation at 409-19 Tyson Street, to cost about $175,000.

BLUEFIELD, W. VA.—The Fordson Coal Company, operated by the Ford Motor

Company, Highland Park, Detroit, Mich., has tentative plans for the construction of a number of electrically operated coal tipples at its local properties, to cost about $500,000.

URBANA, VA. — The municipal electric plant was recently damaged by fire.

WASHINGTON, D. C.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 29, for electrical switches, speedometers etc. as per circular (1595).

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until March 25, for a quantity of electric wire and cables for Eastern and Western yards. (Schedule 1967.)

WASHINGTON, D. C.—Bids will be received by the Chief of Engineers, 2828 Munitions Building, until March 25, for 4,000 ft. nine-conductor controller cable, rubber-insulated and lead-covered, and two reels for same. (Circular 24-128.)

WASHINGTON, D. C.—Bids will be received by the Board of District Commissioners until March 17 for one motor-driven centrifugal pump, with starting compensator and accessory apparatus.

North Central States

DETROIT, MICH.—The Detroit Edison Company plans to issue $6,800,000 in capital stock, part of the proceeds to be used for extensions to its system.

DETROIT, MICH.—Plans for the proposed printing plant to be erected by the Detroit Free Press, to cost about $650,000, include the installation of power equipment, control devices, conveying machinery, etc.

SAUGATUCK, MICH.—The Village Council is considering an issue of $10,000 in bonds for the installation of a new ornamental lighting system.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, 227 City Hall, until March 21 for 16,950 ft. of lead-covered cable.

CLEVELAND, OHIO. — The Cleveland Electric Illuminating Company, it is reported, will soon begin work on construction of its proposed new plant at Avon, several miles west of Cleveland. The cost of the plant with the necessary transmission lines, is estimated at $10,000,000.

COLUMBUS, OHIO.—The Columbus Railway, Light & Power Company has submitted a proposal to the City Council offering to supply additional current needed by the municipal electric plant, for which preparations are being made to install a new 7,500-kw. generator. Bids have already been advertised for new equipment.

SWANTON, OHIO. — Steps have been taken by the City Council to establish a municipal electric light plant.

ASHLAND, KY. — The Carter County Clay Company, recently incorporated, plans to build a new plant, including a power house, in the Mount Savage section for the manufacture of face brick and kindred products, to cost about $225,000.

ATTICA, IND. — The Attica Electric Company, recently organized, has been granted permission to take over and merge the Attica Electric & Power Company, the Hillsboro (Ind.) Light Company, and the Newton (Ind.) Electric Light Company; also to issue $200,000 in bonds to finance the project and for proposed line extensions.

DAYTON, ILL. — The Dayton Hydro-Electric Power Company has applied for permission to construct a hydro-electric power plant and to erect transmission lines to Rutland.

GREEN BAY, WIS.—Steps have been taken by a local club, recently organized, to secure an extension of the ornamental lighting system on Broadway and on Dousman Street.

GREEN BAY, WIS. — The Northern Paper Mills Company, Green Bay, is reported to have acquired the White Rapids power site, formerly owned by the White Rapids Paper Company, Oshkosh, on the Menominee River, in Menominee County, Mich. The new owner proposes to develop the power and transmit the electricity to Green Bay for use in connection with its local mills. It is estimated that 10,000 hp. can be developed.

MERRILL, WIS.—The City Council has approved a proposed ordinance providing for the installation of an ornamental lighting system consisting of 145 iron standards mounted with lamps of 400 cp.

MARSHFIELD, WIS.—Extension to the street-lighting system on North Central Avenue is under consideration by the City Council.

MARSHFIELD, WIS.—The City Council has closed a deal to furnish electricity from the municipal electric plant to farmers residing between Marshfield and the towns of Opal and McMillan. The line will be erected by the farmers and operated by the city. The question of furnishing electrical service to farmers residing between Marshfield and Hewitt, a distance of about 5 miles, is under consideration. The farmers offer to erect the line and when completed turn it over to the city.

MILWAUKEE, WIS.—Preliminary plans are being prepared by the Milwaukee Electric Railway & Light Company for a steam-turbine room. F. A. Luber is architect and engineer.

NEENAH, WIS.—The City Council has authorized the Waterworks Commission to expend $30,000 to equip the waterworks pumping station with electrically operated pumps to replace the present steam plant. It is proposed to install a new oil-engine-driven generating unit.

RACINE, WIS.—The Traffic Department has recommended to the City Council the installation of arterial highway mushroom lamps at all important intersections throughout the city. More than twenty-five lamps will be needed at once.

RHINELANDER, WIS.—The proposal to issue $150,000 in bonds to build a new underground water-supply system, to be equipped with electrically operated pumping machinery, will be submitted to the voters on April 1.

STEVENS POINT, WIS. — The City Council is considering the rearrangement of the city lighting system and replacing it with new equipment. Extension of the lighting system to the outlying districts is also under consideration.

WISCONSIN RAPIDS, WIS.—The Electric Light and Water Commission is considering the erection of a transmission line from here to Vesper, a distance of 12 miles, to furnish electric service in Vesper and to farmers along the route of the proposed line.

CONWAY, IOWA.—Bonds to the amount of $4,500 have been voted for the erection of an electric transmission line to replace the present local plant.

DAVENPORT, IOWA. — Plans for the proposed local plant of the Linwood Cement Company, to cost about $115,000, include a power house.

ROCK VALLEY, IOWA.—An election will be held March 31 to vote on the proposal to issue $20,000 in bonds for a municipal electric distribution system. Electricity, it is understood, will be furnished by parties who proposed to build an electric plant and now are asking for a twenty-five-year franchise in Rock Valley.

MEXICO, MO.—The Missouri Power & Light Company, recently organized, has acquired the property of the Missouri Utilities Company. Extensions and improvements, it is understood, will be made, including the erection of a transmission line from Jefferson City to Auxvasse and a line from Clarke through Moberly to La Plata.

ST. LOUIS, MO.—The Union Electric Light & Power Company has closed a contract with the Pittsburgh Plate Glass Company to supply electricity to the latter at its plant in Crystal City, for a period of ten years. The Union company will extend its transmission to Crystal City, a distance of about 30 miles.

ST. LOUIS, MO.—Bids will be received by T. Graebner, secretary Building Commission, Concordia Seminary, 3618 Texas Avenue, until March 24 (extended date) for construction of dormitories, academic buildings, dining hall, library, professors' house and power plant, to cost about $2,000,000. Day & Klauder, Franklin Building, Philadelphia, are architects, and H. H. Morrison, Fullerton Building St. Louis, is engineer.

CRAB ORCHARD, NEB.—A special election has been called to vote bonds for the construction of a transmission line and local electric distribution system. Electricity will be obtained from the municipal plant at Seward.

LEWISTON, NEB.—A special election will be held March 26 to vote bonds for the installation of an electric distributing system. Electricity will be obtained from the municipal plant at Seward.

SEWARD, NEB.—An agreement has been reached by the towns of Filley, Virginia, Lewiston and Crab Orchard with the Blue River Power Company, Seward, for electrical service, subject to the approval of the voters. Elections will soon be held in these towns to vote on the proposal. Under the agreement the company is to furnish electricity for a period of twenty years. Each town is to vote $8,000 in bonds as its portion of the cost of the transmission and to build the distribution system in the town, the cost of which is estimated at about $5,000. The cost of the transmission lines is estimated at $32,000.

SUPERIOR, NEB. — The Southern Nebraska Power Company, a subsidiary of the United Light & Power Company, Abilene, Kan., has awarded a contract to Stone & Webster, 147 Milk Street, Boston, to build a dam 380 ft. long and 8 ft. high across the Republican River, near Superior.

VIRGINIA, NEB.—A special election will be held on March 26 to vote on the proposal to issue bonds for a light and power distributing system. It is proposed to secure electricity from the municipal electric plant at Seward.

Southern States

DUNN, N. C.—Bids will be received by the Mayor and Board of Town Commissioners until March 27 for improvements to waterworks and sewerage systems, including construction of pumping station and complete filter plant, motor-driven pumps and accessories, 1¼ miles of 2,200-volt transmission line, etc. The Gilbert C. White Company, Durham, N. C., is engineer.

RUTHERFORD, N. C.—Bids, it is understood, will soon be asked by the City Council for the installation of an ornamental lighting system and for extension to water mains. The Carolina Engineering Company, Wilmington, is engineer.

CHARLESTON, S. C. — Electric power equipment will be installed in the proposed local oil storage and distributing plant, near Shipyard Creek, to be erected by the Gulf Refining Company, Frick Annex, Pittsburgh, Pa., at a cost of about $750,000.

LAURENS, S. C.—The Department of Public Works is considering the installation of an ornamental lighting system on several streets.

ATLANTA, GA.—Dr. N. P. Pratt, care of Charles O. Lenz, consulting engineer, Atlanta, is at the head of a project to construct and operate a hydro-electric power plant on the Coosawattee River, Gilmer County, with initial capacity of about 50,000 hp., to cost about $4,000,000, including transmission system.

JACKSONVILLE, FLA.—The Board of Public Utilities contemplates making a survey with a view of extending the service of the municipal electric light plant to Green Cove Springs.

ST. AUGUSTINE, FLA.—The City Commission is planning to install 100 additional lamps in the newly annexed territory.

CHATTANOOGA, TENN.—A bond issue of $3,000,000 for the Tennessee Electric Power Company has been approved by the Public Utilities Commission, the proceeds to be used for plant extension, new transmission lines, etc., in various parts of the state.

GRAYSVILLE, TENN.—The Graysville Light & Power Company recently organized, is reported to be considering the erection of a 5-mile transmission line. L. O. Morin is president.

NASHVILLE, ARK. — A company is being organized to construct a local cement mill, to cost about $100,000. The plans include a power house. P. C. Allen is interested in the project.

BATON ROUGE, LA.—Knox & Amiss are planning to build an underground conduit system for commercial and street-lighting service on a tract of land near the Louisiana State University, now being developed for residential purposes.

LAFAYETTE, LA.—At an election to be held March 27 the proposal to issue $200,000 in bonds for repairs to the municipal water and light plant will be submitted to the voters.

MONROE, LA.—The local power plant, machine and blacksmith shops of the Missouri Pacific Railway Company were recently damaged by fire.

ALTUS, OKLA.—The installation of a new engine in the municipal electric plant is reported to be under consideration.

ELK CITY, OKLA.—The States Power Company, Helena, has been granted a franchise to supply electricity here. The company, it is understood, will erect a power plant in Elk City.

MUSKOGEE, OKLA.—Surveys, it is reported, have been made by the Oklahoma Central Power Company for the erection of a 66,000-volt transmission line from

Muskogee to Drumright, a distance of 87 miles, to cost about $300,000. The Byllesby Engineering Company, 208 South La Salle Street, Chicago, is engineer.

PAWHUSKA, OKLA. — The Council is considering the installation of new equipment at the municipal electric plant, including a Diesel oil engine, generator, exciter, etc.

SHIDLER, OKLA.—Plans for proposed extensions to the municipal waterworks, to cost about $120,000, include electrically operated pumping machinery.

BEAUMONT, TEX.—The Eastern Texas Electric Company has been organized under Delaware laws with capital of $2,500,000 to take over the local company of the same name. Tentative plans are being considered for the purchase of additional properties in this district and extensions to transmission lines.

HASKELL, TEX.—Plans have been prepared by the Western Cotton Oil Company for a factory and power plant to cost about $40,000.

HOUSTON, TEX.—The Houston Lighting & Power Company contemplates building a mechanical repair and service building to cost about $75,000.

TERRELL, TEX.—Plans are being prepared by the Texas Midland Railroad Company for equipping its line from Ennis to Paris, via Terrell, a distance of 110 miles, for electrical operation.

Pacific and Mountain States

ANACORTES, WASH.—The Puget Sound Power & Light Company has applied to the City Council for a franchise in Anacortes. If granted, it is said, the company plans to take over the local system of the Washington Water, Power & Light Company.

NORTH BEND, ORE. — The Mountain States Power Company, it is stated, will soon begin construction of its proposed new local plant, to cost about $600,000.

TILLAMOOK, ORE.—The installation of a new lighting system for the business section and additional lamps for the residential sections is under consideration. F. F. Conover is a member of the committee appointed to look into the matter.

BAKERSFIELD, CAL.—Plans have been completed for the installation of the second unit of the street-lighting system, and a call for bids has been authorized. W. D. Clarke is city engineer.

CHICO, CAL.—The installation of an ornamental lighting system on Broadway, Main and other streets, to cost about $25,000, is under consideration. F. A. Lammison is city engineer.

LOS ANGELES, CAL.—Plans have been prepared by the Gay Engineering Company, 2650 Santa Fe Avenue, for an ice plant for F. A. Maginnis, Kerckhoff Building, to cost about $75,000.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has completed plans for the construction of a switching station on East Eight Street, near South Mission Street, to cost about $25,000. It will be erected by day labor and cost about $25,000.

SANTA ROSA, CAL.—The Pacific Gas & Electric Company has secured permission to construct an outdoor transformer substation on Ellis Street, to cost about $50,000.

SUISUN, CAL.—The installation of an ornamental lighting system is under consideration.

CAMBRIDGE, IDAHO.—The Public Utilities Commission has instructed the Adams County Light & Power Company to increase the output of its plant to meet the demands for service.

POCATELLO, IDAHO.—The installation of street lamps at a number of street intersections in different parts of the city is under consideration.

BILLINGS, MONT.—The Montana Power Company has tentative plans for the erection of a transmission line from Billings to Hardin, about 100 miles.

WELLS, NEV.—A committee has been appointed by the Wells Commercial Club to make investigations relative to the installation of a more adequate water supply and also an electric light and power plant to be operated in connection with the waterworks system.

Canada

VICTORIA, B. C.—Tenders, it is understood, will soon be called by the Department of Public Works for the construction of a power plant in the Essondale section, to cost about $110,000.

GEORGETOWN, ONT. — The Ontario Hydro-Electric Power Commission, Toronto, contemplates extending its transmission line from Georgetown to Norval, to cost about $35,000.

GRIMSBY, ONT.—Tenders are being asked by the town officials for the installation of an electric light and power distribution system, to cost from $25,000 to $50,000.

NIAGARA FALLS, ONT.—The Hydro-Electric Power Commission, Toronto, plans to build a third pipe line to the power house of the Ontario Power Company, to cost about $1,200,000. F. A. Gaby is chief engineer.

TORONTO, ONT.—The Toronto Hydro-Electric System plans to install electric systems in the villages of Dixie, Cooksville, Lakeview and Lorne Park, to cost about $60,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Feb. 26, 1924)

1,484,723. COOLING MEANS FOR ELECTRIC MACHINERY; G. Lenhardt, Berlin-Charlottenburg, and W. Gscheidlen, Berlin-Schmargendorf, Germany. App. filed Nov. 20, 1920.

1,484,732. SWITCHING DEVICE; G. E. Mather, Morsemer, N. J. App. filed Dec. 13, 1920. For telephone substation apparatus.

1,484,733. METHOD OF MAKING FLUORINE; F. C. Mathers, Bloomington, Ind. App. filed June 30, 1919.

1,484,739. IMPULSE TRANSMITTER; W. T. Powell, Rochester, N. Y. App. filed May 7, 1919. For use in telephone systems.

1,484,751. TELEPHONE-EXCHANGE SYSTEM; W. P. Andrick, Hohokus, N. J. App. filed June 8, 1922. For simultaneous signaling and conversing.

1,484,762. TELEGRAPH SYSTEM; G. C. Cummings, East Orange, N. J. App. filed Sept. 17, 1920. For relaying or repeating signal-current impulses.

1,484,765. TELEPHONE SYSTEM; G. D. Edwards, East Orange, N. J. App. filed April 12, 1919. Train dispatching and similar systems.

1,484,771. TELEPHONE SYSTEM; C. L. Goodrum, New York, N. Y. App. filed Nov. 25, 1919. Automatic full-relay system.

1,484,773. ELECTRIC FLATIRON; A. Grouleff and H. A. Holmes, Chicago, Ill. App. filed Dec. 7, 1922.

1,484,779. DRY CELL AND PROCESS OF REDUCING GASEOUS PRESSURE THEREIN; G. W. Heise, Elmhurst, N. Y. App. filed June 30, 1921.

1,484,780. PERMEABLE DEPOLARIZING MASS AND PROCESS OF MAKING THE SAME; G. W. Heise, Elmhurst, N. Y. App. filed Nov. 15, 1921. For dry cells.

1,484,781. PRIMARY ELECTRIC CELL AND PROCESS OF PREPARING DEPOLARIZER THEREFORE; G. W. Heise, Elmhurst, N. Y. App. filed Dec. 14, 1921.

1,484,782. DEPOLARIZING MIXTURE AND METHOD OF PREPARING THE SAME; G. W. Heise, Elmhurst, N. Y. App. filed Jan. 30, 1922. For dry cells.

1,484,783. COATED PRIMARY-CELL ELECTRODE; G. W. Heise, Elmhurst, N. Y. App. filed Feb. 2, 1922.

1,484,784. PROCESS OF MAKING GELATINOUS ALKALINE ELECTROLYTE AND COMPOSITIONS THEREFOR; G. W. Heise, Bayside, N. Y. App. filed Sept. 6, 1922. For galvanic cells.

1,484,813. TURBO-GENERATOR; C. W. Dake, Chicago, Ill. App. filed Aug. 9, 1920. Of the small type with provision for easy inspection, adjustment, etc.

1,484,885. DEPOLARIZING COMPOSITION; C. Hambuechen, New York, N. Y. App. filed July 28, 1921. For electric cells.

1,484,918. ELECTRIC BATTERY; A. V. Wilker, Berea, Ohio. App. filed May 9, 1919. Of dry-cell type.

1,484,926. DRY CELL; R. C. Benner, Fremont, Ohio. App. filed May 18, 1921. Flat-cell construction.

1,484,927. STORAGE-BATTERY SEPARATOR AND PROCESS OF MAKING THE SAME; R. C. Benner, Bayside, and G. W. Heise, Elmhurst, N. Y. App. filed Feb. 25, 1922.

1,484,928. STORAGE-CELL ELECTRODE AND SUPPORT FOR ACTIVE MATERIALS; R. C. Benner, Bayside, N. Y. App. filed Oct. 12, 1922.

1,484,933. TELEPHONE SYSTEM; R. D. Conway, Chatham, N. Y. App. filed Dec. 29, 1919. For signaling over transmission lines.

1,484,941. TELEPHONE-EXCHANGE SYSTEM; C. L. Goodrum, New York, N. Y. App. filed Dec. 29, 1920. Machine switching.

1,484,950. TELEPHONE-EXCHANGE SYSTEM; A. E. Lundell, Chicago, Ill. App. filed April 28, 1920. To extend connections from automatic to manual exchange.

1,484,962. PROTECTION FOR ELECTRIC MOTORS; G. T. Randle, Saylesville, R. I. App. filed Oct. 7, 1919. From dust, moisture, etc.

1,484,963. TELEPHONE-EXCHANGE SYSTEM; A. Raynsford, New York, N. Y. App. filed Sept. 14, 1920. Semi-automatic.

1,484,967. AMPLIFYING SYSTEM; J. C. Schelleng, East Orange, N. J. App. filed Dec. 24, 1920. Electric wave.

1,484,973. AIRPLANE INTERPHONE SET; G. H. Stevenson, Rye, N. Y. App. filed Dec. 11, 1919.

1,484,978. LAMP STAND FOR SHOWCASES; F. L. Wheeler, Berkeley, Cal. App. filed Dec. 26, 1922.

1,484,988. PUBLIC ADDRESS CIRCUITS; H. S. Hamilton, New York, N. Y. App. filed Feb. 9, 1923. With long-distance telephone lines.

1,484,992. ELECTRIC SWIVEL SOCKET; K. Kijima, Los Angeles, Cal. App. filed Jan. 31, 1921.

1,485,005. TELEPHONE-EXCHANGE SYSTEM; J. L. Wright, Cleveland, Ohio. App. filed Aug. 12, 1916. Semi-automatic.

1,485,006. INDUCTION SYNCHRONOUS MOTOR; T. Yamamoto, Tokyo, Japan. App. filed March 2, 1923.

1,485,014. MAGNETO ACCELERATOR; S. B. Booty, East Perth, Australia. App. filed Feb. 24, 1921. For giving rapid rotary impulse to magneto spindle.

1,485,017. TORPEDO-TESTING APPARATUS; J. M. Cohen, Washington, D. C. App. filed Dec. 19, 1919. For measuring the speed.

1,485,076. MEANS FOR FLATTENING THE CURRENT WAVES OF PULSATING DIRECT CURRENT; C. A. A. Haighton, The Hague, Netherlands. App. filed Dec. 20, 1922.

1,485,098. AUTOMOBILE ALARM SYSTEM; R. Varley, Englewood, N. J. App. filed Sept. 9, 1920. To avoid the accidental draining of the battery.

1,485,111. RADIO TRANSMISSION SYSTEM; J. Bethenod, Paris, France. App. filed Aug. 2, 1921.

1,485,120. ARC WELDING; J. F. Lincoln, East Cleveland, Ohio. App. filed June 23, 1922.

1,485,127. ARCING MEANS FOR BRUSH HOLDERS; E. Sears, Deer Lodge, Mont. App. filed Sept. 13, 1922. For protection of motor.

1,485,153. ELECTRIC HEATER; F. E. Wolcott, Hartford, Conn. App. filed May 19, 1921. Electric grids or the like.

1,485,156. SYSTEM OF DISTRIBUTION; H. D. Arnold, East Orange, N. J. App. filed Aug. 28, 1917.

1,485,171. SPARK-PLUG TESTER; B. G. Doppes and H. W. Centner, Cincinnati, Ohio. App. filed March 21, 1921.

1,485,175. PLUG RECEPTACLE; A. L. R. Ellis, Lynn, Mass. App. filed March 5, 1921.

1,485,193. TERMINAL MEMBER; J. A. McKay, New York, N. Y. App. filed Oct. 25, 1919. For securing contact in connection with portable fittings.

1,485,196. TELEPHONE TRANSMITTER; R. L. Murray, Bushey Heath, England. App. filed Aug. 24, 1921.

1,485,212. RADIO-TELEGRAPH SYSTEM; J. B. Brady, Somerset, Md. App. filed Dec. 28, 1921.

1,485,215. EXTENSION CORD CONNECTION; E. E. Coar and C. Thilman, South Bend, Ind. App. filed Feb. 24, 1921.

1,485,227. AUTOMATIC CIRCUIT-BREAKER ATTACHMENT FOR HIGH-TENSION TRANSMISSION LINES; T. F. Johnson, Jr., Atlanta, Ga. App. filed May 13, 1920.

1,485,228. CROSS-ARM HOOK FOR ELECTRIC TRANSMISSION LINES; T. F. Johnson, Jr., Atlanta, Ga. App. filed Aug. 26, 1920.

1,485,282. RADIO BATTERY CONSTRUCTION; P. M. Marko, Brooklyn, N. Y. App. filed March 22, 1923.

1,485,287. COMMUTATION OF DIRECT-CURRENT MACHINES; J. Perret, Paris, France. App. filed Nov. 23, 1921.

1,485,288. ALTERNATING-CURRENT MOTOR GROUP; J. Perret and L. Ots, Paris, France. App. filed Jan. 16, 1922. Regulation of.

1,485,289. ELECTRIC COIL AND METHOD OF MAKING SAME; C. F. Peterson, Schenectady, N. Y. App. filed April 20, 1922.

1,485,352. ELECTRIC DISCHARGE APPARATUS; W. D. Coolidge, Schenectady, N. Y. App. filed May 20, 1921. X-ray.

1,485,353. IGNITION APPARATUS; W. S. Harley, Milwaukee, Wis. App. filed Nov. 1, 1919.